PASSIVE COMPONENTS

DATA HANDBOOK

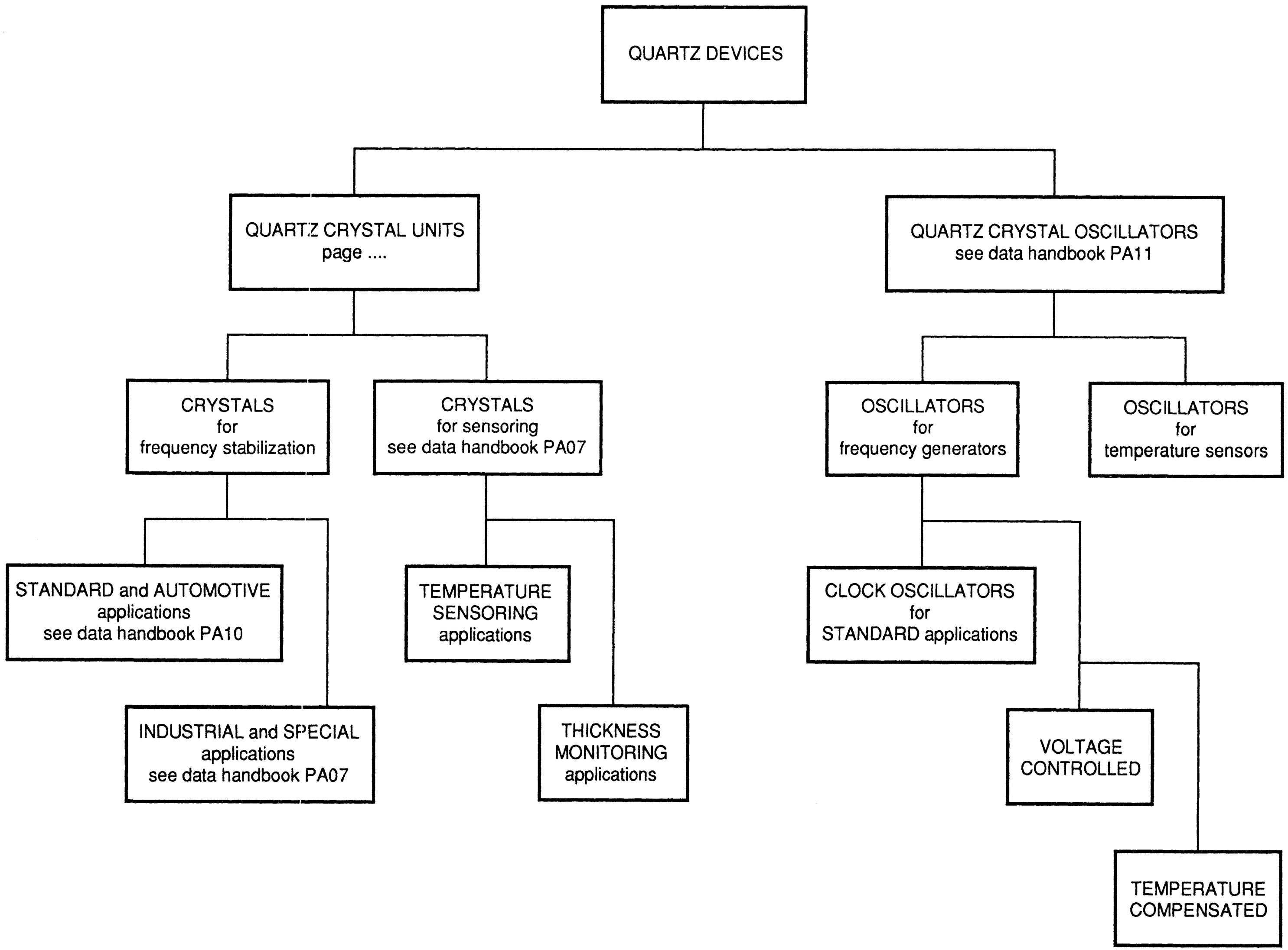
Quartz Oscillators

BOOK PA11 1991

Philips Components

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MLA357

Quartz Oscillators

Contents

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of this specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	

SURVEY OF TYPES

Table 1

TYPE	NOMINAL FREQUENCY (kHz)	TEMPERATURE RANGE (°C)	SUPPLY VOLTAGE (V)
XO	1 000 to 70 000	0 to +70	5 ±10%
XOHC	1 000 to 50 000	0 to +70	5 ±10%
VCXO	1 000 to 31 000	–5 to +70	5 ±5%
VTCXO	8 000 to 16 000	–30 to +80	5 ±5%
TCXO	4 000 to 50 000	–40 to +85	5 or 12
DTCXO	4 000 to 15 000	–40 to +85	5 ±5%
TSO	0.250 to 750	–40 to +85	5 ±10%

GENERAL INTRODUCTION

For practical reasons, technical information on piezo-electric quartz devices is separated into three parts:

PA07 - Quartz crystals for industrial and special applications

PA10 - Quartz crystals for automotive and standard applications

PA11 - Quartz oscillators

The quartz crystal controlled oscillators consist in general of a quartz crystal and an oscillator circuit, packaged together in a hermetically sealed encapsulation. When connected to an appropriate supply voltage, the oscillator produces an output signal with a certain waveform and frequency. For applications where a high frequency stability is required, a temperature compensating network is added to the oscillator circuit which reduces the original temperature drift of the quartz crystal unit with a factor of 20 to 60. The range of quartz controlled oscillators comprise the following main groups:

Quartz crystal clock oscillator (XO)

The XO's and XOHC's are small oscillators in a DIL-14/4 encapsulation without temperature compensation. The output characteristic is designed for TTL and HCMOS - level applications with symmetric waveform. Microprocessor and logic circuitry are typical applications for XO's and XOHC's.

Voltage controlled quartz crystal oscillators (VCXO)

A VCXO is a crystal oscillator the frequency of which can be changed by means of a control voltage. The relation between frequency and control voltage approaches a straight line. They feature LS-TTL and HCMOS output compatibility. VCXO's are specially suitable for phase locked loop applications as used in ISDN multiplex equipment.

Voltage controlled and temperature compensated quartz crystal oscillators (VTCXO)

These oscillators can be tuned electrically by means of a DC voltage, or can be modulated by an AC voltage while the circuit is electronically temperature compensated. Excellent fitting in portable telephones.

Temperature compensated quartz crystal oscillators (TCXO)

In the TCXO's an analog circuit is incorporated which compensates the temperature influence on the frequency stability of the oscillator. TCXOs are available with stability figures of ±1 to ±3 x10^{-6}. Oscillators of this type are used e.g. in measuring and communication equipment.

Digitally temperature compensated quartz crystal oscillators (DTCXO)

The DTCXO is the latest development in temperature compensated crystal oscillator design. Temperature compensation is carried out by means of a digital circuit and is based upon the following principle: A memory chip contains a table with temperature correction data for both crystal and oscillator over the quartz crystal temperature range, e.g.
–40 to +85 °C.
The memory is adressed by a digital (quartz) thermometer. So at each temperature within this range, a particular memory cell contains the

SUPPLY CURRENT (mA)	FREQUENCY STABILITY (± x10^{-6})	ADJUSTMENT FACILITY	OUTPUT COMPATIBILITY
30 to 50	±100	none	TTL
4 to 25	±100	none	HCMOS
6 to 12.5	±20	control voltage	HCMOS
4 to 15	±1	external variable capacitor or resistor	sinewave semi-TTL or HCMOS
2.5	±1.5	control voltage	clipped sinewave
15	±0.5	external variable resistor	LS-TTL or HCMOS
2.5	N.A.	none	HCMOS

specific correction factor to keep the output frequency within very close tolerances.
Oscillators of this type show a frequency stability of < ±0.5 x10^{-6} in the temperature range of –40 to +85 °C.
DTCXO's are used in high-professional equipment especially where high frequency stability combined with low power consumption, small dimensions and no warming-up time is required.

Temperature sensoring quartz crystal oscillators (TSO)

In the TSO the frequency is a function of the temperature. For this oscillator a special crystal cut is used with a high sensitivity for temperature changes. The temperature information is available in a digital format so no Analog Digital Conversion is needed. The TSO's are used as temperature sensing devices in measurement and industrial equipment e.g. for correction of measurement-errors caused by ambient temperature changes.

TERMS AND DEFINITIONS

Nominal frequency

The frequency assigned to the oscillator when operated under specified conditions.

Frequency offset

The frequency difference, positive or negative, which should be added to the specified nominal frequency of the oscillator, when adjusting the oscillator frequency at +25 °C, in order to minimize it's deviation from nominal frequency over the specified operating temperature.

Frequency tuning range

Frequency tuning range is the range over which the oscillator frequency may be varied by means of an external resistor or by an external capacitance for the purpose of:

Setting the frequency to a particular value e.g. to give a frequency offset.

Correcting the oscillator frequency after deviation due to ageing or other changed conditions.

Operating temperature range

The temperature range over which the oscillator shall function, maintaining frequency and other output signal attributes within specified tolerances.

Operable temperature range

The temperature range over which the oscillator shall continue to provide an output signal, though not within the specified tolerances of frequency, level, waveform, etc.

Storage temperature range

The temperature range within the (non operating) oscillator may be stored for a prolonged time without any damage.

Frequency ageing

The relationship between oscillator frequency and time. This long-term frequency drift is caused by secular changes in the quartz crystal and/or other elements of the oscillator circuit, and is expressed as fractional change in mean frequency per specified time interval (e.g. ±1 x10^{-6} per year).

Table 2 Crystal clock oscillators - Type selection

TYPE	NOMINAL FREQUENCY (kHz)	TEMPERATURE RANGE (°C)	SUPPLY VOLTAGE (V)
XO	1 000 to 70 000	0 to +70	5
XOHC	1 000 to 50 000	0 to +70	5

Table 3 Voltage controlled crystal oscillators - Type selection

TYPE	FREQUENCY RANGE (kHz)	TEMPERATURE RANGE (°C)	SUPPLY VOLTAGE (V)
VCO 2	7 000 to 21 000	–5 to +60	5 ±5%
VCO 3	1 000 to 10 000	–5 to +55	5 ±5%
VCO 4	7 000 to 17 000	0 to +70	5 ±5%
VCO 5	17 000 to 31 000	0 to +70	5 ±5%
VCO 6	7 000 to 17 000	0 to +60	5 ±5%
VCO 7	7 000 to 27 000	0 to +70	5 ±5%

Table 4 Temperature compensated crystal oscillator - Type selection

TYPE HR	PACKAGE	FREQUENCY RANGE (kHz)	SUPPLY VOLTAGE (V)
TC201	B2	4 000 to 20 000	5 to 12
TC202	B2	4 000 to 20 000	5
TC301	B3	4 500 to 15 000	12
TC302	B3	4 500 to 12 000	12
TC303	B3	4 000 to 20 000	12
TC304	B3	4 000 to 20 000	12
TC305	B3	20 000 to 50 000	12
TC501	B5	6 000 to 20 000	5
TC502	B5	6 000 to 20 000	5
TC601	B6	6 000 to 20 000	5
TC602	B6	6 000 to 20 000	5

Table 5 Voltage controlled temperature compensated crystal oscillator

TYPE HR	PACKAGE	FREQUENCY RANGE (kHz)	SUPPLY VOLTAGE (V)
VTCO1	B8	8 000 to 16 000	5
VTCO2	B8	8 000 to 16 000	5
VTCO3	B8	8 000 to 16 000	5
VTCO4	B8	8 000 to 16 000	5

SUPPLY CURRENT (mA)	FREQUENCY STABILITY (± x10^{-6})	MAXIMUM HEIGHT OVER PCB (mm)	OUTPUT COMPATIBILITY
30 to 50	±100	6.5	T.T.L.
4 to 25	±100	6.5	HCMOS

SUPPLY CURRENT (mA)	CONTROL VOLTAGE (V)	FREQUENCY STABILITY (± x10^{-6})	MAXIMUM HEIGHT OVER PCB (mm)	OUTPUT COMPATIBILITY
6	−5 to +5	±20	7.3	HCMOS
6	−4 to +4	±20	7.3	HCMOS
6	0.5 to 4.5	±25	7.3	HCMOS
12.5	0.5 to 4.5	±20	10.9	HCMOS
9	1.0 to 4.0	±10	10.9	HCMOS
6	0.5 to 4.5	±25	9.0	HCMOS

TEMPERATURE RANGE (°C)	FREQUENCY STABILITY (± x10^{-6})	ADJUSTMENT FACILITY	OUTPUT COMPATIBILITY	PAGE
−40 to +85	±1.0	variable R	sine	41
−40 to +85	±1.0	variable R	semi T.T.L.	45
−20 to +70	±2.0	variable C	sine	49
−20 to +70	±2	variable R	sine	54
−40 to +85	±1	variable C	sine	59
−40 to +85	±1	variable R	sine	63
−20 to +70	±2	variable C	sine	67
−40 to +85	±1.0	variable R	sine	72
−40 to +85	±1.0	variable R	semi T.T.L.	76
−20 to +70	±1.0	variable R	sine	80
−20 to +70	±1.0	variable R	semi T.T.L.	84

SUPPLY CURRENT (mA)	FREQ. DEVIATION IN x10^{-6} IN TEMP. RANGE −30/+80 °C	FREQ. DEVIATION VS VOC CHANGES 5 V ±5% (x10^{-6})	FREQ. MODULATION x10^{-6}
3 max.	±1.5	±0.2	±4.0
3 max.	±2.5	±0.3	±7.0
3 max.	±4.0	±0.5	±19.0

Data sheet	
status	Product specification
date of issue	March 1991

9922 515 71 series
Crystal clock oscillator Type XO

DESCRIPTION

The XO comprises a quartz crystal and an oscillator assembled together on a film substrate. The assembly is encapsulated in a hermetically sealed metal housing. The package has four connecting pins with pin spacing compatible with 14-pin DIL packages.

TESTS AND REQUIREMENTS

See 'Tests and requirements', Table 1

APPLICATIONS

- Microprocessors
- Measuring equipment
- Medical equipment
- Electronic timers

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
f_n	nominal frequency range	1000	70000	kHz
$\Delta f/f$	frequency stability (all effects and tolerances included)	−100	+100	x 10^{-6}
T_{op}	operating temperature range	0	+70	°C
V_{CC}	supply voltage	4.5	5.5	V
n	fan-out	-	10	TTL load
	mass	-	4.5	g

Crystal clock oscillator Type XO — 9922 515 71 series

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f_n	nominal frequency range	square wave output	1000	-	70000	kHz
$\Delta f/f$	frequency stability	all effects and tolerances included	−100	-	+100	$\times 10^{-6}$
V_{CC}	supply voltage	pin 14 to pin 7	4.5	5	5.5	V
I_{CC}	supply current	f = 1000 to 8000 kHz f = 8000 to 40000 kHz f = 40000 to 70000 kHz	- - -	- - -	50 40 55	mA mA mA
V_{osc}	oscillator output	see note	-	TTL	-	-
	duty cycle	1.4 V level; T_o = 25 °C	40		60	%
n	fan-out		-	-	10	TTL load
T_{op}	operating temperature range		0	-	70	°C
T_{stg}	storage temperature range		−55	-	+125	°C
tr, tf	rise, fall time	0.4 - 2.4 V	-	5	-	ns
t_{st}	start up time	1 - 40 MHz 40 - 70 MHz	- -	- -	10 15	ms ms

Note to the electrical data

Output options like tri-state, enable/disable are available on request.

MECHANICAL DATA

Dimensions in mm

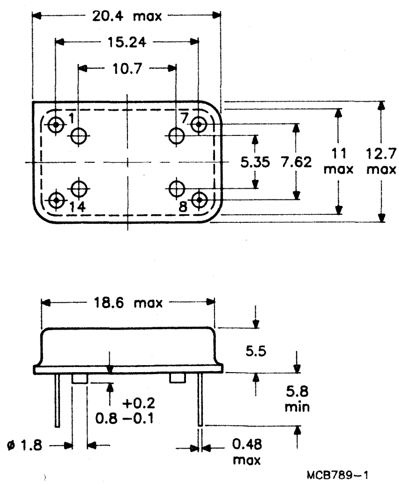


Fig.1 Package outline.

Crystal clock oscillator Type XO 9922 515 71 series

PINNING

SYMBOL	PIN	DESCRIPTION
n.c.	1	n. c. or control input
GND	7	ground (case)
V_{osc}	8	oscillator output
V_{CC}	14	supply voltage

Marking

frequency in kHz
last five digits of catalogue code:
code for month and year of manufacture

Table 1 Tests and requirements

IEC68-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
Db	accelerated damp-heat	+25 to +55 °C 6 cycles at > 95% R.H.	$\Delta f/f \leq \pm 5 \times 10^{-6}$
Ea	shock	100 g half-sine 6 directions 1 blow/direction	$\Delta f/f \leq \pm 5 \times 10^{-6}$
Ed	free fall	250 mm on hard wood	
Fc	vibration	frequency 10-500 Hz acceleration 20 g 3 directions 30 min.	no damage $\Delta f/f \leq \pm 5 \times 10^{-6}$
Nb	rapid change of temperature	1 h –40 °C/1 h +85 °C 10 cycles	no damage $\Delta f/f \leq \pm 5 \times 10^{-6}$
Qc	sealing gross leak	method 1	no bubbles
Ta	solderability	235 ± 5 °C 2 ± 0.5 s	good tinning, except for 1 mm from body
Tb-1a	resistance to soldering heat	260 ± 5 °C 10 ± 1 s	$\Delta f/f \leq \pm 5 \times 10^{-6}$
IEC 679-1	ageing	storage for 1000 h at +70 °C	$\Delta f/f \leq \pm 10 \times 10^{-6}$

Philips Components

Data sheet	
status	Product specification
date of issue	March 1991

9922 515 72 series
Crystal clock oscillator Type XOHC

DESCRIPTION

The XOHC comprises a quartz crystal and an oscillator assembled together on a substrate. The assembly is encapsulated in a hermetically sealed metal housing. The package has four connecting pins with pin spacing compatible with 14-pin DIL packages.

TESTS AND REQUIREMENTS

See 'Tests and requirements', Table 1

APPLICATIONS

- Microprocessors
- Measuring equipment
- Medical equipment
- Electronic timers

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
f_n	nominal frequency range	1000	50000	kHz
$\Delta f/f$	frequency stability (all effects and tolerances included)	– 100	+100	$x\ 10^{-6}$
T_{op}	operating temperature range	0	+70	°C
V_{CC}	supply voltage	4.5	5.5	V
n	fan-out	- -	15 10	LSTTL load HCMOS load
	mass	-	4.5	g

Crystal clock oscillator Type XOHC — 9922 515 72 series

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f	frequency range	square wave output	1000	-	50000	kHz
Δf/f	frequency stability	all effects and tolerances included	−100	-	+100	x 10^{-6}
V_{CC}	supply voltage	pin 14 to pin 7	4.5	5	5.5	V
I_{CC}	supply current	f = 1000 to 8000 kHz f = 8000 to 20000 kHz f = 20000 to 50000 kHz	- - -	- - -	15 20 30	mA mA mA
V_{osc}	oscillator output	see note	-	HCMOS	-	-
	duty cycle	50% V_{CC} level; T_o = 25 °C	40	-	60	%
n	fan-out		- -	- -	15 10	LSTTL load HCMOS load
T_{op}	operating temperature range		0	-	70	°C
T_{stg}	storage temperature range		−55		+125	°C
t_r,t_f	rise, fall time	15 pF load	-	5	-	ns
t_{st}	start up time	1 - 40 MHz 40 - 50 MHz	- -	- -	10 15	ms ms

Note to electrical data

Output options like tristate, enable/disable are available on request.

MECHANICAL DATA

Dimensions in mm

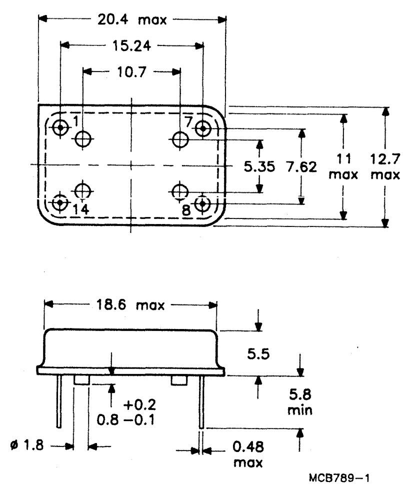


Fig.1 Package outline.

Crystal clock oscillator Type XOHC 9922 515 72 series

PINNING

SYMBOL	PIN	DESCRIPTION
V_{contr}	1	n.c. or control input
GND	7	ground (case)
V_{osc}	8	oscillator output
V_{CC}	14	supply voltage

Marking

frequency in kHz

last five digits of catalogue code:

code for month and year of manufacture

Table 1 Tests and requirements

IEC68-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
Db	accelerated damp-heat	+25 to +55 °C 6 cycles at > 95% R.H.	$\Delta f/f \leq \pm 5 \times 10^{-6}$
Ea	shock	100 g half-sine 6 directions 1 blow/direction	$\Delta f/f \leq \pm 5 \times 10^{-6}$
Ed	free fall	250 mm on hard wood	
Fc	vibration	frequency 10-500 Hz acceleration 20 g 3 directions 30 min.	no damage $\Delta f/f \leq \pm 5 \times 10^{-6}$
Nb	rapid change of temperature	1 h –40 °C/1 h +85 °C 10 cycles	no damage $\Delta f/f \leq \pm 5 \times 10^{-6}$
Qc	sealing gross leak	method 1	no bubbles
Ta	solderability	235 ± 5 °C 2 ± 0.5 s	good tinning, except for 1 mm from body
Tb-1a	resistance to soldering heat	260 ± 5 °C 10 ± 1 s	$\Delta f/f \leq \pm 5 \times 10^{-6}$
Δf/f	ageing	storage for 1000 h at +70 °C	$\Delta f/f \leq \pm 10 \times 10^{-6}$

Philips Components

Data sheet	
status	Product specification
date of issue	March 1991

9922 515 602 series

Voltage controlled crystal oscillator Type VCO 2

DESCRIPTION

The type VCO 2 voltage controlled oscillator comprises a quartz crystal and two HCMOS integrated circuits assembled together in a metal housing that is dry-nitrogen-filled and hermetically sealed. The package has four connecting pins with pin spacing compatible with 14-pin DIL packages.

TESTS AND REQUIREMENTS

See 'Tests and requirements', Table 1

APPLICATIONS

- Clock recovery circuits (phase-locked loops)
- Multiplexing equipment in digital telephone networks
- Local area networks

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
f_n	nominal frequency range	7000	-	21000	kHz
$\Delta f/f$	frequency stability (all effects and tolerances included)	-	-	± 45	x 10^{-6}
V_{CC}	supply voltage range	4.75	5	5.25	V
V_{contr}	control voltage range	–5	-	+5	V
Z_L	output load	-	-	3	TTL load
T_{op}	operating temperature range	–5	-	+60	°C
	mass	-	3.9	-	g

Voltage controlled crystal oscillator Type VCO 2

9922 515 602 series

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating conditions						
V_{CC}	supply voltage		4.75	5	5.25	V
I_{CC}	supply current	note 1, 7-17 mHz 17-21 mHz	- -	6 10	10 -	mA mA
V_{contr}	control voltage range		–5	0.0	+5	V
Z_L	output load (fan out)	15 pF to GND	-	-	3	TTL load
T_{op}	operating temperature range		–5	+25	+60	°C
T_o	operable temperature range		–40	-	+85	°C
T_{stg}	storage temperature range		–40	-	+100	°C
Frequency characteristics						
f_n	nominal frequency range		7000	-	21000	kHz
Δf/f	initial frequency deviation with respect to the nominal frequency (f_n)	V_{contr} = 0 V see note 2	-	-	± 30	x 10^{-6}
Δf/f	frequency deviation due to temperature variation	T_o = –5 to +60 °C	-	-	± 20	x 10^{-6}
Δf/f	frequency deviation due to supply voltage and load variations	V_{CC} = 5 V ± 5% C_L = 15 to 50 pF or unloaded to 3 TTL loads	-	-	± 5	x 10^{-6}
Δf/f	frequency ageing	during 10 years at 60 °C	-	-	± 20	x 10^{-6}
Δf/f	total frequency deviation from the initial frequency at V_{contr} = 0 V due to ageing, temperature, supply voltage and load variations		-	-	± 45	x 10^{-6}
Δf/f	pullability ref. to f_n	V_{CC} = –5 to +5 V	± 130	± 160	± 200	x 10^{-6}
S	pulling sensitivity	inverse monotonic characteristic; f max at V_{contr} = –5 V	–15	–32	–60	x 10^{-6}
Output characteristics						
t_r t_f	rise time fall time	between 10 and 90% between 10 and 90%	- -	- -	15 15	ns ns
	output logic levels	compatible with	-	HCMOS	-	-
	duty cycle	T_{op} = 25 °C V_{contr} = 0 V output level 1.5 V	45		55	%
		T_{op} = –5 +60 °C ΔV_{contr} = –5 to +5 V output level 1.5 V	40		60	%

Notes to the electrical data

1. Maximum value shows the worst case over the full operating temperature and control voltage ranges. Supply voltage is decoupled internally.
2. The initial frequency deviation does not degrade the margin between pullability and stability as the pullability is stated relative to the nominal frequency.

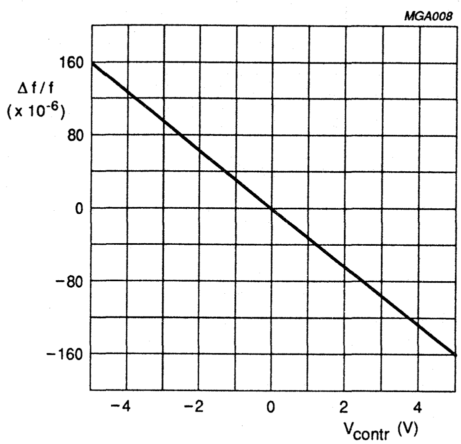


Fig.1 Frequency as a function of control voltage characteristic (typical curve).

MECHANICAL DATA

Dimensions in mm

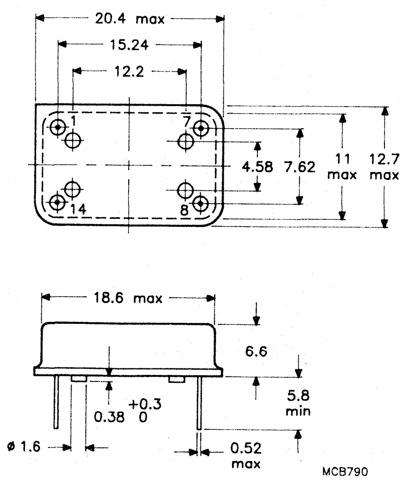


Fig.2 Package outline.

Voltage controlled crystal oscillator Type VCO 2

9922 515 602 series

PINNING

SYMBOL	PIN	DESCRIPTION
V_{contr}	1	control voltage
GND	7	ground (case)
V_{osc}	8	oscillator output
V_{CC}	14	supply voltage

Marking

frequency in kHz last five digits of catalogue code:
code for month and year of manufacture

Table 1 Tests and requirements

IEC68-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
Db	accelerated damp-heat	+25 to +55 °C 6 cycles at > 95% R.H.	$< \pm 5 \times 10^{-6}$
Ea	shock	100 g half-sine 6 directions 1 blow/direction	$< \pm 5 \times 10^{-6}$
Ed	free fall	250 mm on hard wood	$< \pm 5 \times 10^{-6}$
Fc	vibration	frequency 10-500 Hz acceleration 20 g 3 directions 30 min.	$< \pm 5 \times 10^{-6}$
Nb	rapid change of temperature	1 h –40 °C/1 h +85 °C 10 cycles	$< \pm 5 \times 10^{-6}$
Qc	sealing gross leak		no bubbles
Qk	sealing fine leak	16 h 700 kPa He	$< 1 \times 10^{-8}$ Ncc/s He
Ta-1	solderability	235 ± 5 °C 2 ± 0.5 s	good tinning
Tb-1a	resistance to soldering heat	260 ± 5 °C 10 ± 1 s	$< \pm 5 \times 10^{-6}$
Ub	bending of wire terminations	1 time 90 load 5 N	no leaks
	ageing	1000 h 70 °C	$< \pm 5 \times 10^{-6}$

Data sheet	
status	Product specification
date of issue	March 1991

9922 515 603 series
Voltage controlled crystal oscillator Type VCO 3

DESCRIPTION

The type VCO 3 voltage controlled oscillator comprises a quartz crystal, an oscillator circuit, a voltage-reference and a divider-circuit. The package has four connecting pins with pin spacing compatible with 14-pin DIL packages.

TESTS AND REQUIREMENTS

See 'Tests and requirements', Table 1

APPLICATIONS

- Clock recovery circuits (phase-locked loops)
- Multiplexing equipment in digital telephone networks
- Local area networks

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
f_n	nominal frequency range	1000	-	10000	kHz
$\Delta f/f$	frequency stability (all effects and tolerances included)	-	-	± 45	x 10^{-6}
V_{CC}	supply voltage range	4.75	5	5.25	V
V_{contr}	control voltage range	–4	-	+4	V
Z_L	output load	-	-	3	TTL load
T_{op}	operating temperature range	–5	-	+55	°C
	mass	-	3.9	-	g

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating conditions						
V_{CC}	supply voltage		4.75	5	5.25	V
I_{CC}	supply current	note 1,	-	4	8	mA
V_{contr}	control voltage range		–4	0.0	+4	V
Z_L	output load (fan out)	including 15 pF to GND	-	-	3	TTL load
t_s	start-up time		-	-	10	ms
C_L	output load capacitance		-	-	50	pF
T_{op}	operating temperature range		–5	-	+55	°C
T_{op}	operable temperature range		–20	-	+70	°C
T_{stg}	storage temperature range		–40	-	+100	°C
Frequency characteristics						
f_n	nominal frequency range		1000	-	10000	kHz
Δf/f	initial frequency deviation with respect to the nominal frequency (f_n)	V_{contr} = 0 V note 2	-	-	± 15	x 10^{-6}
Δf/f	frequency deviation due to temperature variation	T_{op} = –5 to +55 °C	-	-	± 20	x 10^{-6}
Δf/f	frequency deviation due to supply voltage and load variations	ΔV_{CC} = 5V ± 5% C_L = 15 to 50 pF or unloaded to 3TTL loads	-	± 1.5	-	x 10^{-6}
Δf/f	frequency ageing	during 10 years at 55 °C	-	-	± 20	x 10^{-6}
Δf/f	total frequency deviation from the initial frequency at V_{contr} = 0 V due to ageing, temperature, supply voltage and load variations		-	-	± 45	x 10^{-6}
S	pullability with reference to f_n	V_{contr} = – 4 to +4 V	-	± 220	-	x 10^{-6}/V
(Δf/f)	Pulling sensitivity	inverse monotonic characteristic; f_{max} at V_{contr} = –4 V	-	–55	-	x 10^{-6}
Output characteristics						
t_r	rise time	between 10 and 90%	-	-	10	ns
t_f	fall time	between 10 and 90%	-	-	10	ns
	output logic levels	compatible with HCMOS	-	-	-	
	duty cycle	T_o = –5 to +55 °C V_{contr} = –4 to +4 V output level 2.5 V	-	-	50	%

Notes to the electrical data

1. Maximum value shows the worst case over the full operating temperature and control voltage ranges. Supply voltage is decoupled internally.
2. The initial frequency deviation does not degrade the margin between pullability and stablility as the pullability is stated relative to the nominal frequency.

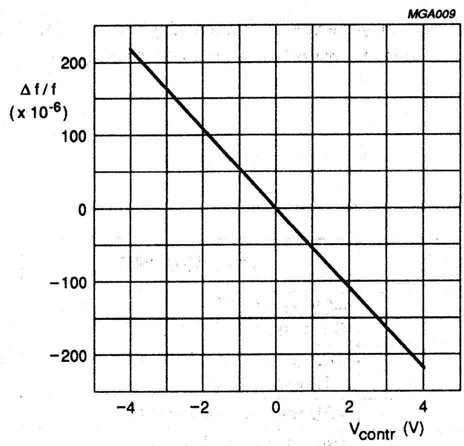


Fig.1 Frequency as a function of control voltage characteristic (typical curve).

MECHANICAL DATA

Dimensions in mm

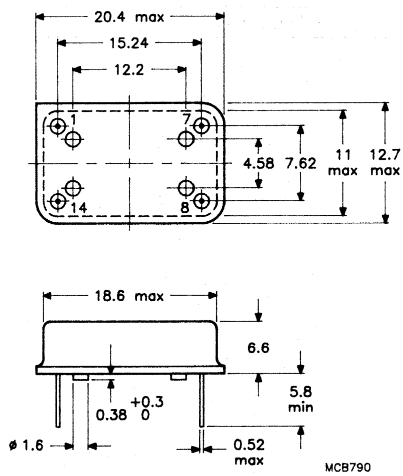


Fig.2 Package outline.

Voltage controlled crystal oscillator Type VCO 3

9922 515 603 series

PINNING

SYMBOL	PIN	DESCRIPTION
V_{contr}	1	control voltage
GND	7	ground (case)
V_{osc}	8	oscillator output
V_{CC}	14	supply voltage

Marking

frequency in kHz last five digits of catalogue code:
code for month and year of manufacture

Table 1 Tests and requirements

IEC68-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
Db	accelerated damp-heat	+25 to +55 °C 6 cycles at > 95% R.H.	$< \pm 5 \times 10^{-6}$
Ea	shock	100 g half-sine 6 directions 1 blow/direction	$< \pm 5 \times 10^{-6}$
Ed	free fall	250 mm on hard wood	$< \pm 5 \times 10^{-6}$
Fc	vibration	frequency 10-500 Hz acceleration 20 g 3 directions 30 min.	$< \pm 5 \times 10^{-6}$
Nb	rapid change of temperature	1 h –40 °C/1h +85 °C 10 cycles	$< \pm 5 \times 10^{-6}$
QC	sealing gross leak		no bubbles
Qk	sealing fine leak	16 h 700 kPa He	$< 1 \times 10^{-8}$ Ncc/s He
Ta-1	solderability	235 ± 5 °C 2 ± 0.5 s	good tinning
Tb-1a	resistance to soldering heat	260 ± 5 °C 10 ± 1 s	$< \pm 5 \times 10^{-6}$
Ub	bending of wire terminations	1 time 90 load 5 N	no leaks
	ageing	1000 h 70 °C	$< \pm 5 \times 10^{-6}$

Data sheet	
status	Product specification
date of issue	March 1991

9922 515 604 series
Voltage controlled crystal oscillator Type VCO 4

DESCRIPTION

The type VCO 4 voltage controlled oscillator comprises a quartz crystal and a HCMOS buffer circuit assembled together in a metal housing that is dry-nitrogen-filled and hermetically sealed. The package has connecting pins with pin spacing compatible with 14-pin DIL packages.

TESTS AND REQUIREMENTS

See 'Tests and requirements', Table 1

APPLICATIONS

- Clock recovery circuits (phase-locked loops)
- Multiplexing equipment in digital telephone networks
- Local area networks

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
f_n	nominal frequency range	7000	-	17000	kHz
$\Delta f/f$	frequency stability (all effects and tolerances included)	-	-	± 50	x 10^{-6}
V_{CC}	supply voltage range	4.75	5	5.25	V
V_{contr}	control voltage range	0.5	-	+4.5	V
Z_L	output load	-	-	3	TTL load
T_{op}	operating temperature range	0	-	+70	°C
	mass	-	3.9	-	g

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating conditions						
V_{CC}	supply voltage		4.75	5	5.25	V
I_{CC}	supply current	note 1	-	6	10	mA
V_{contr}	control voltage range		+0.5	+2.5	+4.5	V
Z_L	output load (fan out)	including 15 pF to GND	-	-	3	TTL load
t_s	start-up time		-	2	-	ms
C_L	output load capacitance		-	-	50	pF
T_{op}	operating temperature range		0	-	+70	°C
T_{stg}	storage temperature range		–40	-	+100	°C
Frequency characteristics						
f_n	nominal frequency range		7000	-	17000	kHz
Δf/f	initial frequency deviation with respect to the nominal frequency (f_n)	V_{contr} = +2.5 V note 2	-	-	± 20	$x\ 10^{-6}$
Δf/f	frequency deviation due to temperature variation	T_{op} = 0 to +70 °C	-	-	± 25	$x\ 10^{-6}$
Δf/f	frequency deviation due to supply voltage and load variations	ΔV_{CC} = 5 V ± 5% C_L = 15 to 50 pF or unloaded to 3 TTL loads	-	-	± 5	$x\ 10^{-6}$
Δf/f	frequency ageing	during 10 years at 70 °C	-	-	± 20	$x\ 10^{-6}$
Δf/f	total frequency deviation from the initial frequency at V_{contr} = +2.5 V due to ageing, temperature, supply voltage and load variations		-	-	± 50	$x\ 10^{-6}$
Δf/f	pullability with reference to f_n	ΔV_c = +0.5 to +4.5 V	± 80	± 100	± 120	$x\ 10^{-6}$
S	pulling sensitivity	positive monotonic characteristic; f_{max} at V_{contr} = +4.5 V	-	+50	-	$x\ 10^{-6}$
Output characteristics						
t_r	rise time	between 10 and 90%	-	-	10	ns
t_f	fall time	between 10 and 90%	-	-	10	ns
	output logic levels	compatible with	-	HCMOS	-	-
	duty cycle	T_o = 0 to 70 °C V_{contr} = +0.5 to +4.5 V output level 2.5 V	40	-	60	%

Notes to the electrical data

1. Maximum value shows the worst case over the full operating temperature and control voltage ranges. Supply voltage is decoupled internally.
2. The initial frequency deviation does not degrade the margin between pullabilty and stability as the pullability is stated relative to the nominal frequency.

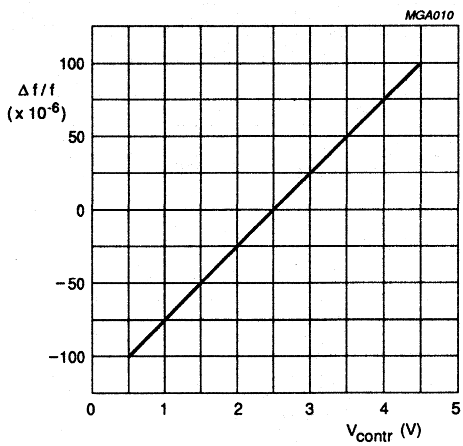


Fig.1 Frequency as a function of control voltage characteristic (typical curve).

MECHANICAL DATA

Dimensions in mm

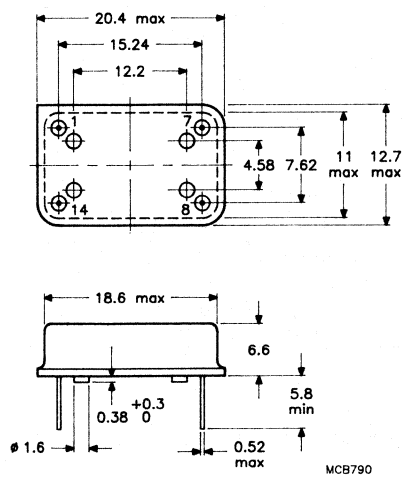


Fig.2 Package outline.

Voltage controlled crystal oscillator Type VCO 4

9922 515 604 series

PINNING

SYMBOL	PIN	DESCRIPTION
V_{contr}	1	control voltage
GND	7	ground (case)
V_{osc}	8	oscillator output
V_{CC}	14	supply voltage

Marking

frequency in kHz last five digits of catalogue code:
code for month and year of manufacture

Table 1 Tests and requirements

IEC68-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
Db	accelerated damp-heat	+25 to +55 °C 6 cycles at > 95% R.H.	$< \pm 5 \times 10^{-6}$
Ea	shock	100 g half-sine 6 directions 1 blow/direction	$< \pm 5 \times 10^{-6}$
Ed	free fall	250 mm on hard wood	$< \pm 5 \times 10^{-6}$
Fc	vibration	frequency 10-500 Hz acceleration 20 g 3 directions 30 min.	$< \pm 5 \times 10^{-6}$
Nb	rapid change of temperature	1 h –40 °C/1 h +85 °C 10 cycles	$< \pm 5 \times 10^{-6}$
Qc	sealing gross leak		no bubbles
Qk	sealing fine leak	16 h 700 kPa He	$< 1 \times 10^{-8}$ Ncc/s He
Ta-1	solderability	235 ± 5 °C 2 ± 0.5 s	good tinning
Tb-1a	resistance to soldering heat	260 ± 5 °C 10 ± 1 s	$< \pm 5 \times 10^{-6}$
Ub	bending of wire terminations	1 time 90 load 5 N	no leaks
	ageing	1000 h 70 °C	$< \pm 5 \times 10^{-6}$

Philips Components

Data sheet	
status	Development-data
date of issue	March 1991

9922 514 605 series
Voltage controlled crystal oscillator Type VCO 5

DESCRIPTION

The type VCO 5 voltage controlled oscillator is a high-frequency unipolar device. It comprises a quartz crystal and an oscillator circuit using surface mounted techniques. The assembly is encapsulated in a metal housing. The package has five connecting pins.

TESTS AND REQUIREMENTS

See 'Tests and requirements', Table 1

APPLICATIONS

- Clock recovery circuits (phase-locked loops)
- Multiplexing equipment in digital telephone networks
- Local area networks

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
f_n	nominal frequency range	17000	-	31000	kHz
$\Delta f/f$	frequency stability (all effects and temperature ranges included)	-	-	± 40	x 10^{-6}
V_{CC}	supply voltage range	4.75	5	5.25	V
V_{contr}	control voltage range	0.5	-	+4.5	V
T_{op}	operating temperature range	0	-	+70	°C

Voltage controlled crystal oscillator Type VCO 5

9922 514 605 series

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating conditions						
V_{CC}	supply voltage		4.75	5	5.25	V
I_{CC}	supply current	note 1	-	12.5	20	mA
V_{contr}	control voltage range		0.5	-	+4.5	V
Z_L	output load (fan out)	including 15 pF to GND	-	-	3	TTL load
T_{op}	operating temperature range		0	-	+70	°C
T_{stg}	storage temperature range		–25	-	+85	°C
Frequency characteristics						
f_n	nominal frequency range		17000	-	31000	kHz
$\Delta f/f$	initial frequency deviation with respect to the nominal frequency	V_{contr} = 2.5 V note 2	-	-	± 20	x 10^{-6}
$\Delta f/f$	frequency deviation due to temperature variation	ΔT_{op} = 0 to +70 °C	-	-	± 20	x 10^{-6}
$\Delta f/f$	frequency deviation due to supply voltage and load variations	ΔV_{CC} = 5 V ± 5% C_L = 15 to 50 pF or unloaded to 3TTL loads	-	-	± 5	x 10^{-6}
$\Delta f/f$	frequency ageing	during 1000 h at 85 °C	-	± 10	-	x 10^{-6}
$\Delta f/f$	total frequency deviation from the initial frequency at V_{contr} = 2.5 V due to ageing, temperature supply voltage and load variations		-	-	± 40	x 10^{-6}
$\Delta f/f$	pullability with reference to the nominal frequency	ΔV_{contr} = 0.5 to +4.5 V	-	± 60		x 10^{-6}
Output characteristics						
	output logic levels	compatible with	-	HCMOS	-	-
	duty cycle	T_{op} = 0 -70 °C V_{contr} = +0.5 to +4.5 V output level 2.5 V	40	-	60	%

Notes to electrical data

1. Maximum value shows the worst case over the full operating temperature and control voltage ranges. Supply voltage is decoupled internally.

2. The initial frequency deviation does not degrade the margin between pullability and stability as the pullability is stated relative to the nominal frequency.

Voltage controlled crystal oscillator Type VCO 5

9922 514 605 series

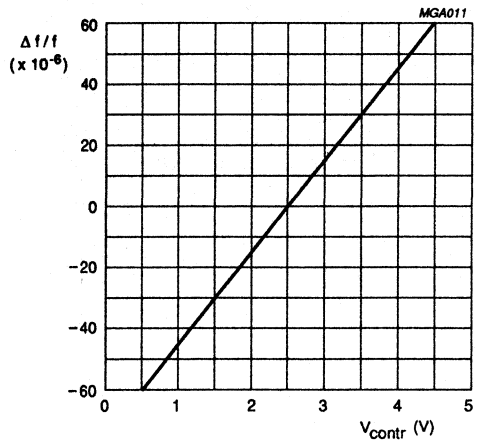


Fig.1 Frequency as a function of control voltage characteristic (typical curve).

MECHANICAL DATA

Dimensions in mm

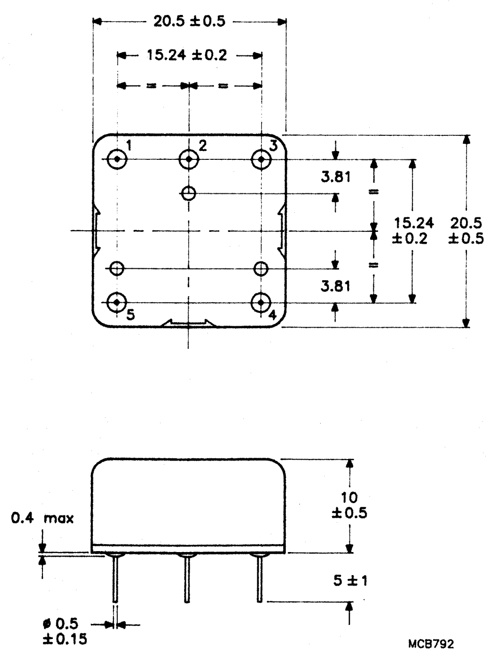


Fig.2 Package outline.

Voltage controlled crystal oscillator Type VCO 5

9922 514 605 series

PINNING

SYMBOL	PIN	DESCRIPTION
V_{CC}	1	supply voltage
V_{osc}	2	oscillator output
GND	3	ground (case)
n.c.	4	not connected
V_{contr}	5	control voltage

Marking

frequency in kHz

last five digits of catalogue code:

code for month and year of manufacture

Philips Components

Data sheet	
status	Development-data
date of issue	March 1991

9922 514 606 series
Voltage controlled crystal oscillator Type VCO 6

DESCRIPTION

The type VCO 6 voltage controlled oscillator has a high pulling sensitivity (typically 100 x 10^{-6}/V) plus a linear and stable frequency control characteristic. It comprises a quartz crystal and an oscillator circuit using surface mounted techniques. The assembly is encapsulated in a metal housing.

TESTS AND REQUIREMENTS

See 'Tests and requirements'
To be fixed.

APPLICATIONS

- Clock recovery circuits (phase-locked loops)
- Multiplexing equipment in digital telephone networks
- Local area networks

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
f_n	nominal frequency range	7000	-	17000	kHz
Δf/f	frequency stability (all effects and tolerances included)	-	-	± 40	x 10^{-6}
V_{CC}	supply voltage range	4.75	5	5.25	V
V_{contr}	control voltage range	1	-	4	V
Z_L	output load	-	-	3	TTL load
T_{op}	operating temperature range	0	-	+60	°C
	mass	-	7.5	-	g

Voltage controlled crystal oscillator Type VCO 6

9922 514 606 series

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating conditions						
V_{CC}	supply voltage		4.75	5	5.25	V
I_{CC}	supply current		-	9	15	mA
V_{contr}	control voltage range		1	-	4	V
T_{op}	operating temperature range		0	-	60	°C
Frequency characteristics						
f_n	nominal frequency range		7000	-	17000	kHz
s	pulling sensitivity		-	+ 100	-	$\times 10^{-6}$
Δf/f	pullability with reference to the nominal frequency (f_n)	V_{contr} = +1 to +4 V	-	± 150	-	$\times 10^{-6}$
Δf/f	total frequency deviation from the ideal frequency transfer function due to calibration, temperature, supply voltage, load and ageing variations		-	-	± 40	$\times 10^{-6}$
Output characteristics						
	output logic levels	compatible with	-	HCMOS	-	-
	duty cycle		40	-	60	%

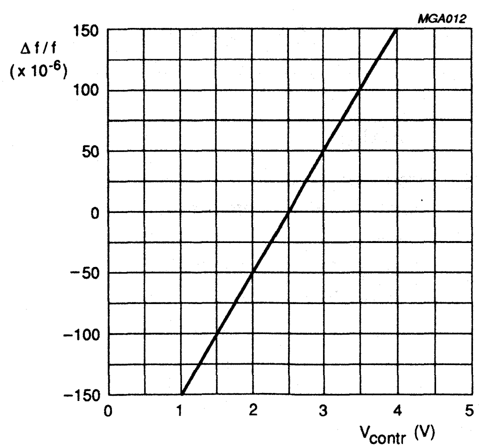


Fig.1 Frequency as a function of control voltage characteristic (typical curve).

Voltage controlled crystal oscillator Type VCO 6

9922 514 606 series

MECHANICAL DATA

Dimensions in mm

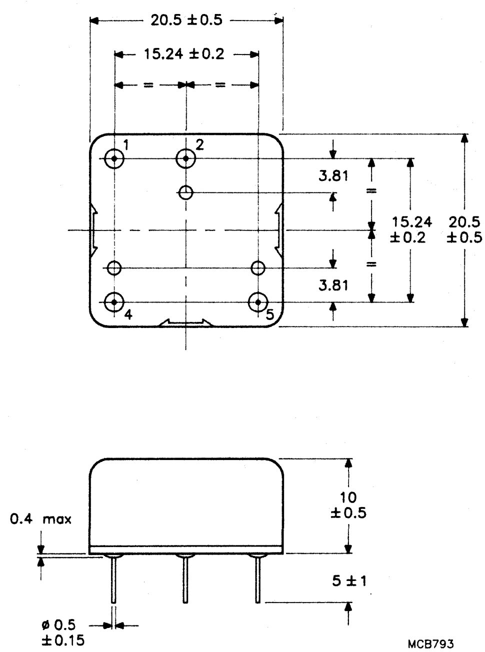


Fig.2 Package outline.

PINNING

SYMBOL	PIN	DESCRIPTION
V_{CC}	1	supply voltage
V_{osc}	2	oscillator output
V_{contr}	4	control voltage
GND	5	ground (case)

Marking

frequency in kHz
last five digits of catalogue code:
code for month and year of manufacture

Philips Components

Data sheet	
status	Objective specification
date of issue	March 1991

9922 519 1 series
Voltage controlled crystal oscillator Type VCO 7

DESCRIPTION

The type VCO 7 voltage controlled oscillator is a unipolar device. It comprises a quartz crystal and an oscillator circuit assembled using surface mounted techniques. The assembly is encapsulated in a metal housing that has four connecting pins with pin spacing compatible to 14/4-pin DIL packages.

TESTS AND REQUIREMENTS

See 'Tests and requirements'
To be fixed

APPLICATIONS

- Clock recovery circuits (phase-locked loops)
- Multiplexing equipment in digital telephone networks
- Local area networks

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
f_n	nominal frequency range	7000	-	27000	kHz
$\Delta f/f$	frequency stability in the temperature range	-	-	±25	x 10^{-6}
V_{CC}	supply voltage range	4.75	5	5.25	V
V_{contr}	control voltage range	0.5	-	4.5	V
T_{op}	operating temperature range	0	-	+70	°C
	mass	-	3.7	-	g

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating conditions						
V_{CC}	supply voltage		4.75	5	5.25	V
I_{CC}	supply current		-	6	-	mA
V_{contr}	control voltage range		0.5	-	4.5	V
T_{op}	operating temperature range		0	-	70	°C
Frequency characteristics						
f_n	nominal frequency range		7000	-	27000	kHz
$\Delta f/f$	frequency stability in the temperature range		-	-	±25	$\times 10^{-6}$
S	pulling sensitivity		-	+50	-	$\times 10^{-6}$/V
$\Delta f/f$	frequency deviation over control voltage range 0.5 to + 4.5 V		-	± 100	-	$\times 10^{-6}$
$\Delta f/f$	initial frequency deviation with respect to nominal frequency	V_{contr} = 2.5 V see note	-	-	± 20	$\times 10^{-6}$
Output characteristics						
	output logic levels	compatible with	-	HCMOS	-	-
	duty cycle		40	-	60	%

Note to electrical data

The initial frequency deviation does not degrade the margin between pullability and stability as the pullability is stated relative to the nominal frequency.

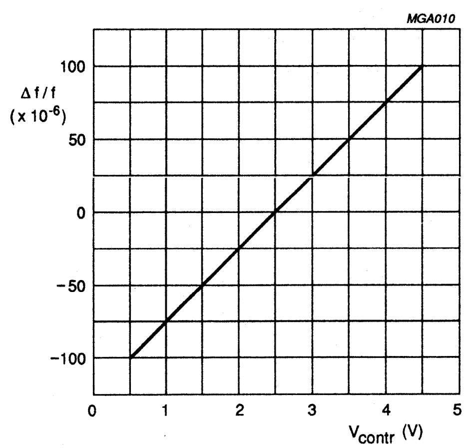


Fig.1 Frequency as a function of control voltage characteristic (typical curve).

Voltage controlled crystal oscillator Type VCO 7

9922 519 1 series

MECHANICAL DATA

Dimensions in mm

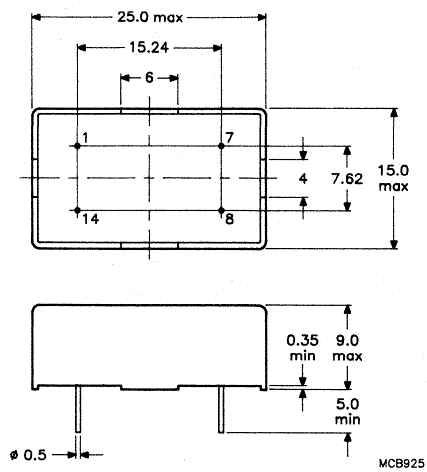


Fig.2 Package outline.

PINNING

SYMBOL	PIN	DESCRIPTION
V_{contr}	1	control voltage
GND	7	ground (case)
V_{osc}	8	oscillator output
V_{CC}	14	supply voltage

Marking

frequency in kHz
last five digits of catalogue code:
code for month and year of manufacture

Philips Components

Data sheet	
status	Preliminary specification
date of issue	March 1991

9922 515 0 series
Voltage controlled temperature compensated crystal oscillator

APPLICATIONS

- Cellular telephone (e.g. GSM)
- Mobile and portable radio/telephone
- Communication transceivers
- Cordless telephone

DESCRIPTION

The Voltage controlled Temperature Compensated Crystal Oscillator (VTCXO) is based on an IC and a Quartz Crystal. The IC contains the oscillator, the temperature compensation and the modulation function. The components are assembled on a hybrid circuit. A metal cover is placed on top of the hybrid for shielding. It is available in four versions with different stability and modulation figures.

TESTS AND REQUIREMENTS

See 'Tests and requirements' Table

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
f_n	nominal frequency range	8 000	16 000	kHz
$\Delta f/f$	frequency stability over temperature			
	version 1	–	±1.5	x 10^{-6}
	version 2	–	±2.5	x 10^{-6}
	version 3	–	±4.0	x 10^{-6}
	version 4	–	±8.0	x 10^{-6}
T_o	operating temperature range	–30	+80	°C
V_{osc}	output voltage (peak-to-peak value)	1.0	–	V

Voltage controlled temperature compensated crystal oscillator

9922 515 0 series

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating conditions						
V_{CC}	supply voltage		4.75	5.0	5.25	V
I_{CC}	supply current		–	2.5	3.0	mA
V_{osc}	output voltage (peak-to-peak value)	8 – ≤ 13 MHz	1.0	–	–	V
		13 – ≤ 16 MHz	0.7	–	–	V
Zl	output load		–	–	10	kΩ
			–	–	10	pF
T_o	operating temperature range		–30	+25	+80	°C
T_{op}	operable temperature range		–40	–	+90	°C
T_{stg}	storage temperature		–45	–	+100	°C
t_s	start-up time		–	–	50	ms
Frequency characteristics						
f_n	nominal frequency range		8 000	–	16 000	kHz
Δf/f	frequency deviation as a function of temperature changes	T_{amb} = –30 to +80 °C				
		version 1	–	–	±1.5	x 10^{-6}
		version 2	–	–	±2.5	x 10^{-6}
		version 3	–	–	±4.0	x 10^{-6}
		version 4	–	–	±8.0	x 10^{-6}
Δf/f	frequency deviation as a function of supply voltage changes	V_{CC} = 5 V ±5 %				
		version 1	–	–	±0.2	x 10^{-6}
		version 2	–	–	±0.3	x 10^{-6}
		version 3	–	–	±0.5	x 10^{-6}
		version 4	–	–	±1.0	x 10^{-6}
Δf/f	frequency deviation as a function of load changes	load = 10kΩ//10pF ±10 %				
		version 1	–	–	±0.2	x 10^{-6}
		version 2	–	–	±0.3	x 10^{-6}
		version 3	–	–	±0.5	x 10^{-6}
		version 4	–	–	±1.0	x 10^{-6}
Δf/f	frequency ageing	per year				
		T_{amb} = 35 °C				
		version 1	–	–	±0.5	x 10^{-6}
		version 2	–	–	±0.8	x 10^{-6}
		version 3	–	–	±1.3	x 10^{-6}
		version 4	–	–	±2.5	x 10^{-6}
Δf/f	frequency modulation	note 1				
		version 1	–	±4.0	–	x 10^{-6}
		version 2	–	±7.0	–	x 10^{-6}
		version 3	–	±19.0	–	x 10^{-6}
		version 4	–	±38.0	–	x 10^{-6}

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{contr}	control voltage range	note 1 note 2	±0.6	±0.9	±1.2	V
α	phase noise	offset = 1 kHz	–	–	–	−120 dBc

Notes

1. The figure stated as frequency modulation indicates the nominal modulation obtained when the control voltage has a certain value within a specified range.
2. The control voltage range is relative to a DC bias voltage of 2.5 V ±0.75 V (±0.75 V may be used for calibration at 25 °C and for ageing adjustment).

TESTS AND REQUIREMENTS

Table 1

IEC 68-2	TEST	PROCEDURE
Ea	shock	100 g half-sine 6 directions 1 blow/direction
Ed	free fall	height 500 mm 3 random drops
Fc	vibration	frequency 10 — 500 Hz acceleration 20 g 3 directions, 30 min
Ta-1	solderability	235 ±5 °C 2 ±0.5 s
Tb-1a	resistance to soldering heat	260 ±5 °C 10 ±1 s

After these tests, the oscillator will work according to specification and show no frequency change larger than 0.5 10^{-6}.

MECHANICAL DATA

Table 2 PINNING

SYMBOL	PIN	DESCRIPTION
GND	1	ground (case)
V_{osc}	2	oscillator output
V_{CC}	3	supply voltage
V_{contr}	4	control voltage
MARKING		frequency in MHz code for year and week of manufacture version code

Voltage controlled temperature compensated crystal oscillator

9922 515 0 series

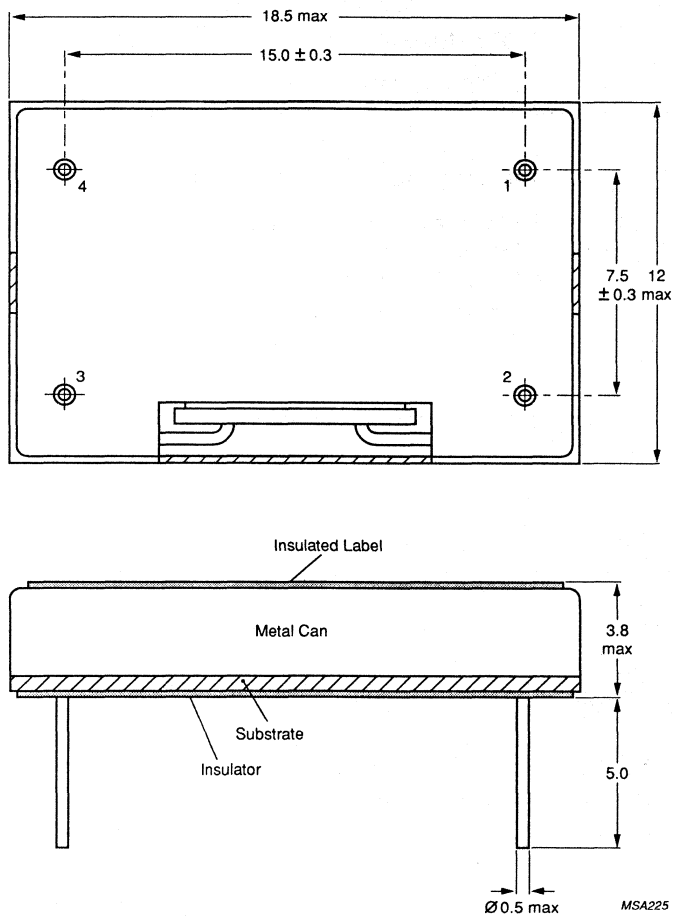


Fig.1 Package outline, dimensions in mm.

Philips Components

Data sheet	
status	Product specification
date of issue	March 1991

9922 511 3 series

Temperature compensated crystal oscillator Type TC 201

DESCRIPTION

Temperature compensated crystal oscillators (TCXOs) comprise a quartz crystal oscillator, and a temperature-controlled circuit that compensates for frequency changes over the whole temperature range. The assembly is contained in a metal housing that is dry-nitrogen-filled and hermetically sealed. The package has five connecting pins which can be mounted on a printed-circuit board, secured by two bolts M2.

TESTS AND REQUIREMENTS

See 'Tests and requirements', Table 1.

APPLICATIONS

- Mobile telephony (base stations)
- Electronic timers
- Electronic measuring equipment
- Frequency synthesizers

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
f_n	nominal frequency range	4000	20000	kHz
$\Delta f/f$	frequency stability in the temperature range: –40 to +85 °C	-	± 1	x 10^{-6}
T_{op}	operating temperature range	–40	+85	°C
V_{CC}	supply voltage range (fixed value)	5	12	V
Z_L	output load (range):	50	1000	Ω
	mass	-	35	g

Temperature compensated crystal oscillator Type TC 201

9922 511 3 series

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CC}	supply voltage range (fixed value)		5	-	12	V
I_{CC}	supply current		-	6	10	mA
f_n	nominal frequency range		4000	-	20000	kHz
Δf/f	frequency tuning range		± 3	± 5	-	x 10^{-6}
Δf/f	frequency stability with respect to the nominal frequency (f_n) after adjustment in the temperature ranges	V_{CC} = 5 to 12 V				
		ΔT_o = –20 to +70 °C	-	-	± 1	x 10^{-6}
		ΔT_o = –40 to +85 °C	-	-	± 1	x 10^{-6}
		V_{CC} = 12 V only				
		ΔT_o = –40 to +85 °C	-	-	± 2	x 10^{-6}
		ΔT_o = –55 to –40 °C	-	-	± 5	x 10^{-6}
		ΔT_o = +85 to +105 °C	-	-	± 5	x 10^{-6}
Δf/f	frequency ageing	per year	-	-	1	x 10^{-6}
Δf/f	frequency deviation due to load impedance variation	ΔZ_L = ± 5%	-	-	± 0.1	x 10^{-6}
Δf/f	frequency variation due to supply voltage variation	per % V_{CC}	-	-	± 0.04	x 10^{-6}
	phase noise	at 1 kHz	-	-	–130	dB_c/Hz
V_{osc}	output voltage (RMS)	Z_L = 50 Ω	200	-	-	mV
		Z_L = 1000 Ω	350	-	-	mV
T_{stg}	storage temperature range		–55	-	+125	°C

Note to the electrical data

The nominal frequency is not guaranteed to occur at room temperature. The frequency can be shifted by connecting a variable resistor (0 to 10 kΩ) between pins 3 and 4. For optimum stability over the whole temperature range, the oscillator should be adjusted to deviate from the nominal frequency by the value given on the label against 'Δf25 °C .. Hz'. After this adjustment, a trimming range of at least ± 3 x 10^{-6} remains available for correcting ageing influences.

Temperature compensated crystal oscillator Type TC 201

9922 511 3 series

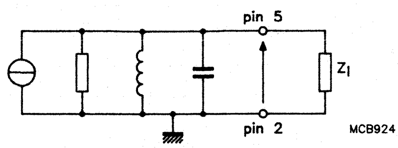
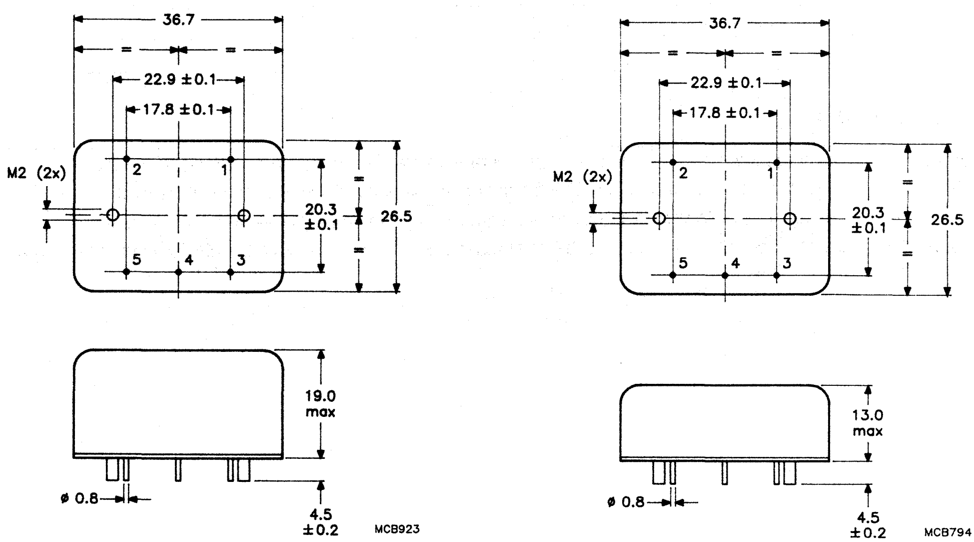


Fig.1 Equivalent output circuit.

MECHANICAL DATA

Dimensions in mm



B2 (4-20 MHz)

B'2 (8-20 MHz)

Fig.2 Package outline.

Temperature compensated crystal oscillator Type TC 201

9922 511 3 series

PINNING

SYMBOL	PIN	DESCRIPTION
GND	2	ground (case)
V_{CC}	1	supply voltage
V_{osc}	5	oscillator output
R_{ext}	4,3	external trimming resistor connected between pins 3 and 4

Marking

Type	catalogue code
Freq. ...MHz	nominal frequency
Δf25 °C ..Hz	value for frequency adjustment
Range ... °C	temperature range
No. .../....	serial number / code for week and year of manufacture

Table 1 Tests and requirements

IEC68-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
Db	accelerated damp-heat	+40 °C 95% R.H.	$\Delta f/f \leq \pm 0.3 \times 10^{-6}$
N	thermal shock	–55 to +105 °C tl = 30 min. 5 cycles relaxation 24 h	$\Delta f/f \leq \pm 0.5 \times 10^{-6}$
Fc	vibration	10 - 2000 Hz 15 g total time: 4 h/axis one octave/min.	$\Delta f/f \leq \pm 1 \times 10^{-6}$
Ea	shock	50 g (1/2 sine) 6 directions 1 blow/direction	$\Delta f/f \leq \pm 1 \times 10^{-6}$
Ta	solderability	235 ± 5 °C. 5 s	good tinning
Tb	resistance to soldering heat	260 ± 5 °C max. 10 s ± 1 s	$< \pm 1 \times 10^{-6}$
	storage	16 h at +105 °C 2 h at –55 °C	$\Delta f/f \leq \pm 0.5 \times 10^{-6}$

Philips Components

Data sheet	
status	Product specification
date of issue	March 1991

9922 511 1 series

Temperature compensated crystal oscillator Type TC 202

DESCRIPTION

Temperature compensated crystal oscillators (TCXOs) comprise a quartz crystal oscillator, and a temperature-controlled circuit that compensates for frequency changes over the whole temperature range. The assembly is contained in a metal housing that is dry-nitrogen-filled and hermetically sealed. The package has five connecting pins which can be mounted on a printed-circuit board, secured by two bolts M2.

TESTS AND REQUIREMENTS

See 'Tests and requirements', Table 1.

APPLICATIONS

- Mobile telephony (base stations)
- Electronic timers
- Electronic measuring equipment
- Frequency synthesizers

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
f_n	nominal frequency range	4000	20000	kHz
$\Delta f/f$	frequency stability in the temperature range: −40 to +85 °C	-	± 1	x 10^{-6}
T_{op}	operating temperature range	−40	+85	°C
V_{CC}	supply voltage	4.75	5.25	V
Z_L	output load (fan-out):	-	3	LSTTL load
	mass	-	35	g

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CC}	supply voltage		4.75	5	5.25	V
I_{CC}	supply current		-	6	10	mA
f_n	nominal frequency range		4000	-	20000	kHz
Δf/f	frequency tuning range		± 3	± 5	-	x 10^{-6}
Δf/f	frequency stability with respect to the nominal frequency (f_n) after adjustment in the temperature range	V_{CC} = 5 V ΔT_o = −20 to +70 °C ΔT_o = −40 to +85 °C	 - -	 - -	 ± 1 ± 1	 x 10^{-6} x 10^{-6}
Δf/f	frequency ageing	per year	-	-	± 1	x 10^{-6}
Δf/f	frequency variation due to supply voltage variation	per % V_{CC}	-	-	0.04	x 10^{-6}
	phase noise	at 1 kHz	-	-	−130	dB_c/Hz
Z_L	output load (fan-out)		-	-	3	LSTTL load
T_{stg}	storage temperature range		−55	-	+105	°C

Note to electrical data

The nominal frequency is not guaranteed to occur at room temperature. The frequency can be shifted by connecting a variable resistor (0 to 10 kΩ) between pins 3 and 4. For optimum stability over the whole temperature range, the oscillator should be adjusted to deviate from the nominal frequency by the value given on the label against 'Δf25 °C .. Hz'. After this adjustment, a trimming range of at least ± 3 x 10^{-6} remains available for correcting ageing influences.

Temperature compensated crystal oscillator Type TC 202

9922 511 1 series

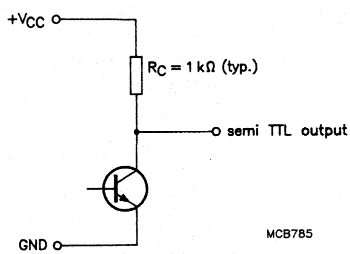
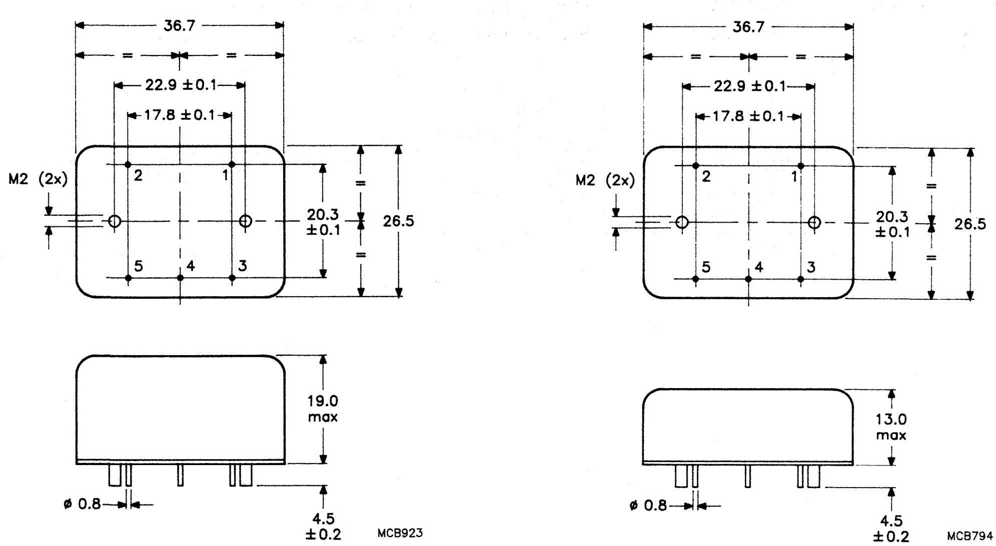


Fig.1 Equivalent output circuit.

MECHANICAL DATA

Dimensions in mm



B2(4-20MHz)

B'2(8-20MHz)

Fig.2 Package outline.

Temperature compensated crystal oscillator Type TC 202

9922 511 1 series

PINNING

SYMBOL	PIN	DESCRIPTION
GND	2	ground (case)
V_{CC}	1	supply voltage
V_{osc}	5	oscillator output
R_{ext}	3,4	external trimming resistor connected between pins 3 and 4

Marking

Type	catalogue code
Freq. ...MHz	nominal frequency
Δf25 °C ..Hz	value for frequency adjustment
Range ... °C	temperature range
No. .../....	serial number / code for week and year of manufacture

Table 1. Tests and requirements

IEC68-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
Db	accelerated damp-heat	+40 °C 95% R.H.	$\Delta f/f \leq \pm 0.3 \times 10^{-6}$
N	thermal shock	–55 to +105 °C tl = 30 min. 5 cycles relaxation 24 h	$\Delta f/f \leq \pm 0.5 \times 10^{-6}$
Fc	vibration	10 - 2000 Hz 15 g total time: 4 h/axis one octave/min.	$\Delta f/f \leq \pm 1 \times 10^{-6}$
Ea	shock	50 g (1/2 sine) 6 directions 1 blow/direction	$\Delta f/f < \pm 1 \times 10^{-6}$
Ta	solderability	235 ± 5 °C. 5 s	good tinning
Tb	resistance to soldering heat	260 °C ± 5 °C 10 s ± 1 s	$< \pm 1 \times 10^{-6}$
	storage	16 h at +105 °C 2 h at –55 °C	$\Delta f/f \leq 0.5 \times 10^{-6}$

Data sheet	
status	Product specification
date of issue	March 1991

9922 510 3 series
Temperature compensated crystal oscillator Type TC 301

DESCRIPTION

Temperature compensated crystal oscillators (TCXOs) comprise a quartz crystal oscillator, and a temperature-controlled circuit that compensates for frequency changes over the whole temperature range. The assembly is contained in a metal housing that is dry-nitrogen-filled and hermetically sealed. The package has five connecting pins which are arranged to fit printed-circuit boards with a grid pitch of 2.54 mm.

TESTS AND REQUIREMENTS

See 'Tests and requirements', Table 1

APPLICATIONS

- Mobile telephony
- Electronic timers
- Electronic measuring equipment
- Frequency synthesizers

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
f_n	nominal frequency range	4500	15000	kHz
$\Delta f/f$	frequency stability over temperature range: class 'A' class 'B' class 'C'	 - - -	 ±2 ±1.5 ±1	 x 10^{-6} x 10^{-6} x 10^{-6}
T_{op}	operating temperature range class 'A' class 'B' class 'C'	 –20 –10 0	 +70 +60 +50	 °C °C °C
V_{CC}	supply voltage	10.8	13.2	V
Z_L	load impedance	500	-	Ω
	mass	-	25	g

Temperature compensated crystal oscillator Type TC 301

9922 510 3 series

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CC}	supply voltage	see Fig.1; R1 = 470 Ω	10.8	12	13.2	V
P_{tot}	total power dissipation		-	-	150	mW
f_n	nominal frequency range		4500	-	15000	kHz
Δf/f	frequency stability with respect to the nominal frequency (f_n) after adjustment:	ΔT_o < 1 K/min; V_{CC} = 12 V; Z_L = 500 Ω				
	frequency deviation due to temperature variation					
	class 'A'	ΔT_o = −20 to +70 °C	-	-	± 2	$\times 10^{-6}$
	class 'B'	ΔT_o = −10 to +60 °C	-	-	± 1.5	$\times 10^{-6}$
	class 'C'	ΔT_o = 0 to +50 °C	-	-	± 1	$\times 10^{-6}$
Δf/f	frequency ageing	per year	-	-	± 1	$\times 10^{-6}$
Δf/f	ageing correction	see note	± 2	-	-	$\times 10^{-6}$
R_i	internal resistance	see Fig.2	2660	2800	2940	Ω
C_i	internal capacitance	see Fig.2	-	5.5	-	pF
V_i	internal voltage source	see Fig.2	360	600	840	mV
Z_L	load impedance		500	-	-	Ω
V_{osc}	output voltage	see Figs 2 and 3	-	-	-	V
T_{stg}	storage temperature range		−25	-	+85	°C

Note to electrical data

The nominal frequency is not guaranteed to occur at room temperature. The frequency can be shifted by connecting a variable capacitor (max. 60 pF) between pins 2 and 3. For optimum stability over the whole temperature range, the oscillator should be adjusted to deviate from the nominal frequency by the value given on the label against 'Δf25 °C .. Hz'. After this adjustment, a trimming range of at least ± 2 $\times 10^{-6}$ remains available for correcting ageing influences.

Temperature compensated crystal oscillator Type TC 301

9922 510 3 series

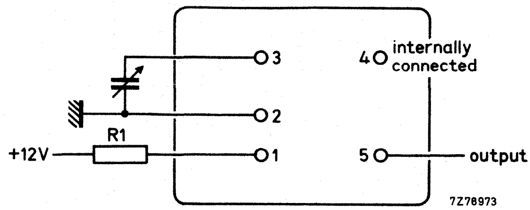


Fig.1 Connection diagram.

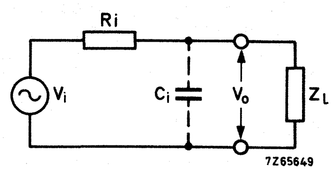


Fig.2 Equivalent circuit.

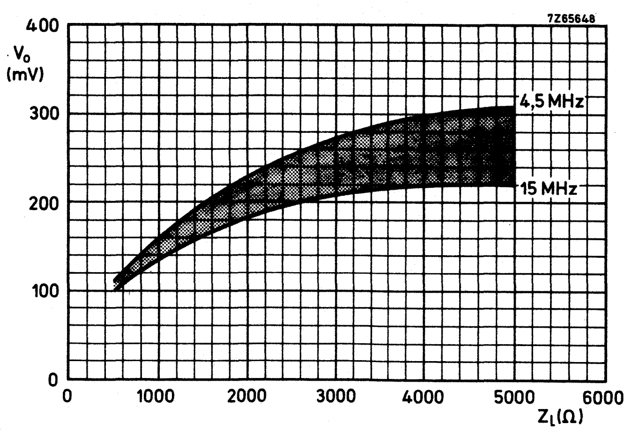


Fig.3 Output voltage (V_O) as a function of load impedance (Z_L); typical values.

MECHANICAL DATA

Dimensions in mm

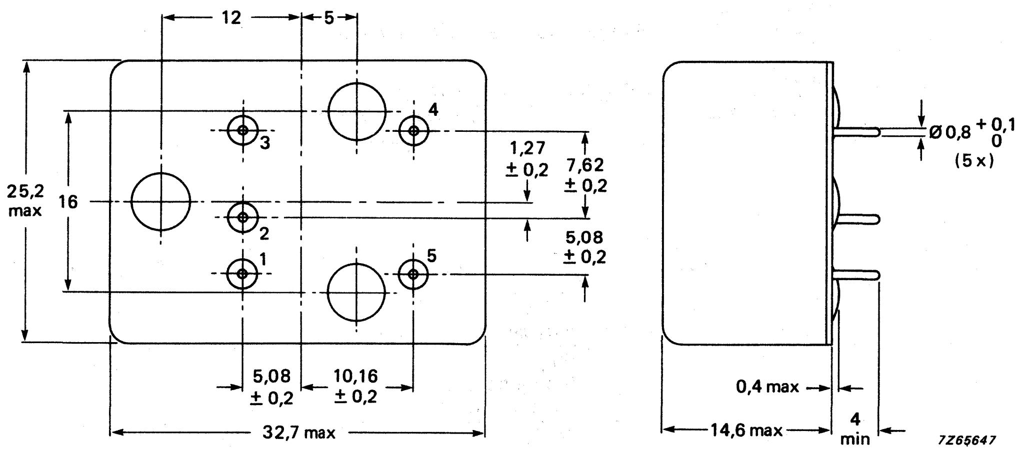


Fig.4 Package outline.

Temperature compensated crystal oscillator Type TC 301

9922 510 3 series

PINNING

SYMBOL	PIN	DESCRIPTION
V_{CC}	1	supply voltage
GND	2	ground (case)
C_{ext}	3	external trimming capacitor connected between pin 3 and GND
i.c.	4	internally connected
V_{osc}	5	oscillator output

Marking

Type	catalogue code
Freq. ...MHz	nominal frequency
Δf25 °C ...Hz	value for frequency adjustment
Range ... °C	temperature range
No. .../....	serial number / code for week and year of manufacture

Table 1 Tests and requirements

IEC68-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
Db	accelerated damp heat	+25 to +55 °C 6 cycles at >95% R.H.	$\Delta f/f < \pm 0.5 \times 10^{-6}$
Ea	shock	50 g 6 directions 1 blow/direction	$\Delta f/f < \pm 0.5 \times 10^{-6}$
Fc	vibration	10-500-10 Hz acceleration 10 g 3 directions 30 min/direction	$\Delta f/f < \pm 0.5 \times 10^{-6}$
Tb	resistance to soldering heat	260 +/– 5 °C 10 +/– 1 s	$\Delta f/f < \pm 0.5 \times 10^{-6}$

Data sheet	
status	Product specification
date of issue	March 1991

9922 510 3 series
Temperature compensated crystal oscillator Type TC 302

DESCRIPTION

Temperature compensated crystal oscillators (TCXOs) comprise a quartz crystal oscillator, and a temperature-controlled circuit that compensates for frequency changes over the whole temperature range. The assembly is contained in a metal housing that is dry-nitrogen-filled and hermetically sealed. The package has five connecting pins which are arranged to fit printed-circuit boards with a grid pitch of 2.54 mm.

TESTS AND REQUIREMENTS

See 'Tests and requirements', Table 1

APPLICATIONS

- Mobile telephony
- Electronic timers
- Electronic measuring equipment
- Frequency synthesizers

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
f_n	nominal frequency range	4500	15000	kHz
$\Delta f/f$	frequency stability over temperature range: class 'A' class 'B' class 'C'	 - - -	 ±2 ±1.5 ±1	 $\times 10^{-6}$ $\times 10^{-6}$ $\times 10^{-6}$
T_{op}	operating temperature range class 'A' class 'B' class 'C'	 −20 −10 0	 +70 +60 +50	 °C °C °C
V_{CC}	supply voltage	10.8	13.2	V
Z_L	load impedance	500	-	Ω
	mass	-	25	g

Temperature compensated crystal oscillator Type TC 302

9922 510 3 series

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CC}	supply voltage	see Fig.1 R1 = 470 Ω	10.8	12	13.2	V
P_{tot}	total power dissipation		-	-	150	mW
f_n	nominal frequency range		4500	-	12000	kHz
Δf/f	frequency stability with respect to the nominal frequency (f_n) after adjustment	see note ΔT_o <1 K/min V_{CC} = 12 V Z_L = 500 Ω				
Δf/f	frequency deviation due to temperature variation class 'A' class 'B' class 'C'	 ΔT_o = −20 to +70 °C ΔT_o = −10 to +60 °C ΔT_o = 0 to +50 °C	 - - -	 - - -	 ± 2 ± 1.5 ± 1	 x 10^{-6} x 10^{-6} x 10^{-6}
Δf/f	frequency ageing	per year	-	-	± 1	x 10^{-6}
Δf/f	ageing correction	see note	± 2	-	-	x 10^{-6}
R_i	internal resistance	see Fig.2	2660	2800	2940	Ω
C_i	internal capacitance	see Fig.2	-	5.5	-	pF
V_i	internal voltage source	see Fig.2	360	600	840	mV
Z_L	load impedance		500	-	-	Ω
V_{osc}	output voltage (RMS value)	see Figs 2 and 3	-	-	-	V
T_{stg}	storage temperature range		−25	-	+85	°C

Note to electrical data

The nominal frequency is not guaranteed to occur at room temperature. The frequency can be shifted by connecting a variable resistor (max. 2 kΩ) between pins 2 and 3. For optimum stability over the whole temperature range, the oscillator should be adjusted to deviate from the nominal frequency by the value given on the label against 'f25 °C .. Hz'. After this adjustment, a trimming range of at least ± 2 x 10^{-6} remains available for correcting ageing influences.

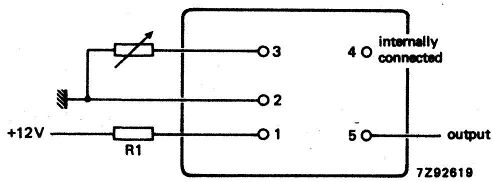


Fig.1 Connection diagram.

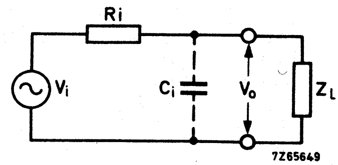


Fig.2 Equivalent circuit.

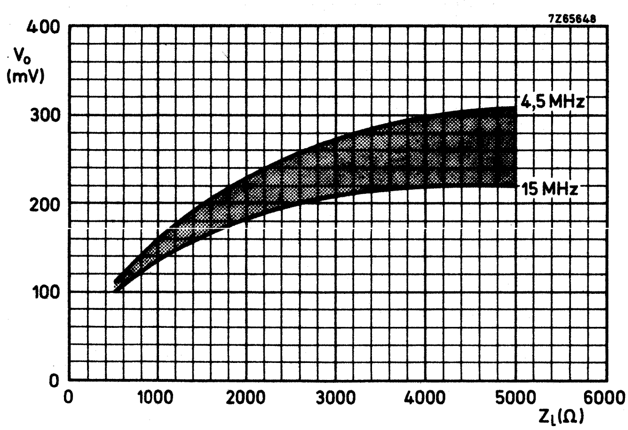


Fig.3 Output voltage (V_o) as a function of load impedance (Z_L); typical values.

Temperature compensated crystal oscillator Type TC 302

9922 510 3 series

MECHANICAL DATA

Dimensions in mm

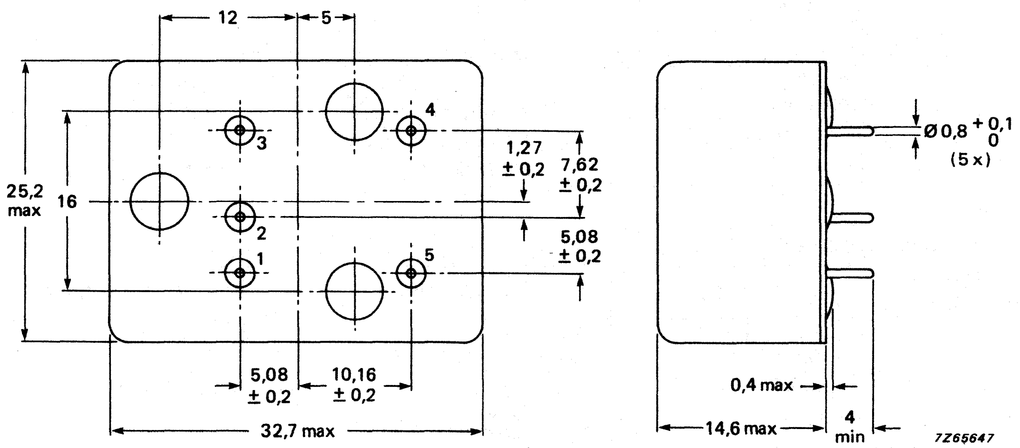


Fig.4 Package outline.

Temperature compensated crystal oscillator Type TC 302

9922 510 3 series

PINNING

SYMBOL	PIN	DESCRIPTION
V_{CC}	1	supply voltage
GND	2	ground (case)
R_{ext}	3	external trimming resistor connected between pin 3 and GND
i.c.	4	internally connected
V_{osc}	5	oscillator output

Marking

Type	catalogue code
Freq. ...MHz	nominal frequency
Δf25 °C ..Hz	value for frequency adjustment
Range ... °C	temperature range
No. .../....	serial number / code for week and year of manufacture

Table 1 Tests and requirements

IEC68-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
Db	accelerated damp heat	+25 to +55 °C 6 cycles at >95% R.H.	$\Delta f/f < \pm 0.5 \times 10^{-6}$
Ea	shock	50 g 6 directions 1 blow/direction	$\Delta f/f < \pm 0.5 \times 10^{-6}$
Fc	vibration	10-500-10 Hz acceleration 10 g 3 directions 30 min/direction	$\Delta f/f < \pm 0.5 \times 10^{-6}$
Tb	resistance to soldering heat	260 +/– 5 °C 10 +/– 1 s	$\Delta f/f < \pm 0.5 \times 10^{-6}$

Philips Components

Data sheet	
status	Product specification
date of issue	March 1991

9922 510 3 series

Temperature compensated crystal oscillator Type TC 303

DESCRIPTION

Temperature compensated crystal oscillators (TCXOs) comprise a quartz crystal oscillator, and a temperature-controlled circuit that compensates for frequency changes over the whole temperature range. The assembly is contained in a metal housing that is dry-nitrogen-filled and hermetically sealed. The package has five connecting pins which are arranged to fit printed-circuit boards with a grid pitch of 2.54 mm.

TESTS AND REQUIREMENTS

See 'Tests and requirements', Table 1

APPLICATIONS

- Mobile telephony
- Electronic timers
- Electronic measuring equipment
- Frequency synthesizers

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
f_n	nominal frequency range	4000	20000	kHz
$\Delta f/f$	frequency stability in the temperature range			
	−20 to +70 °C	-	± 1	x 10^{-6}
	−40 to +85 °C	-	± 1	x 10^{-6}
	−40 to +85 °C	-	± 2	x 10^{-6}
	−55 to −40 °C	-	± 5	x 10^{-6}
	+85 to + 105 °C	-	± 5	x 10^{-6}
T_{stg}	storage temperature range	−55	+125	°C
V_{CC}	supply voltage	11.4	12.6	V
Z_L	output load range	50	1000	Ω
	mass	-	25	g

Temperature compensated crystal oscillator Type TC 303

9922 510 3 series

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CC}	supply voltage		11.4	12	12.6	V
P_{tot}	total power dissipation		-	60	100	mW
f_n	nominal frequency range		4000	-	20000	kHz
Δf/f	frequency tuning range		± 2	± 3	-	x 10^{-6}
Δf/f	frequency stability with respect to the nominal frequency (f_n) after adjustment	ΔT_o = –20 to +70 °C ΔT_o = –40 to +85 °C ΔT_o = –40 to +85 °C ΔT_o = –55 to –40 °C ΔT_o = +85 to +105 °C	- - - - -	- - - - -	± 1 ± 1 ± 2 ± 5 ± 5	x 10^{-6} x 10^{-6} x 10^{-6} x 10^{-6} x 10^{-6}
Δf/f	ageing per year		-	-	± 1	x 10^{-6}
Δf/f	frequency deviation due to load impedance variation	ΔZ_L = ± 5%	-	-	± 1	x 10^{-7}
Δf/f	frequency variation due to supply voltage variation	per % V_{CC}	-	-	± 4	x 10^{-8}
Z_L	output load	fixed value	50	-	1000	Ω
V_{osc}	oscillator output voltage (RMS value)	Z_L = 50 Ω Z_L = 1000 Ω	200 350	- -	- -	mV mV
T_{stg}	storage temperature range		–55	-	+125	°C

Note to electrical data

The nominal frequency is not guaranteed to occur at room temperature. The frequency can be shifted by connecting a variable capacitor (max. 60 pF) between pins 2 and 3. For optimum stability over the whole temperature range, the oscillator should be adjusted to deviate from the nominal frequency by the value given on the label against Δf25 °C .. Hz. After this adjustment, a trimming range of at least ± 2 x 10^{-6} remains available for correcting ageing influences.

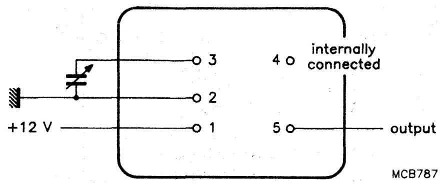


Fig.1 Connection diagram.

MECHANICAL DATA

Dimensions in mm

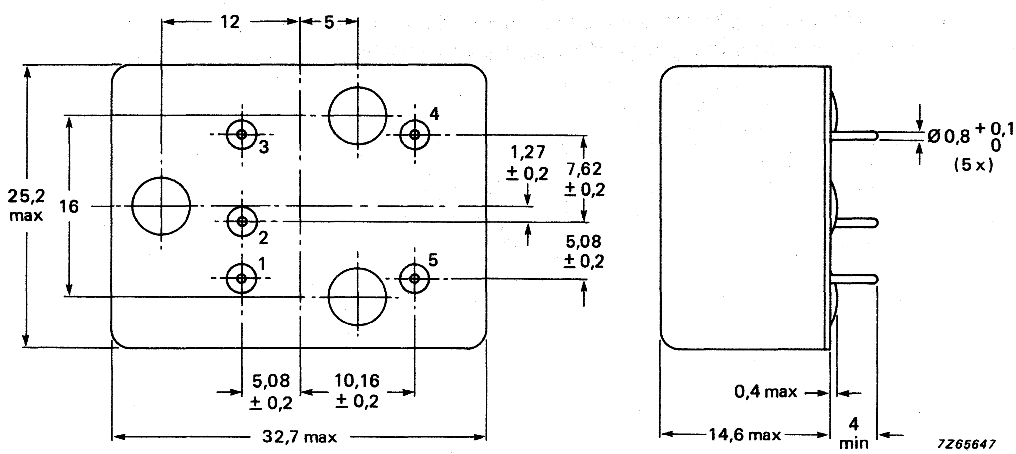


Fig.2 Package outline.

Temperature compensated crystal oscillator Type TC 303

9922 510 3 series

PINNING

SYMBOL	PIN	DESCRIPTION
V_{CC}	1	supply voltage
GND	2	ground (case)
C_{ext}	3	external trimming capacitor connected between pin 3 and ground
i.c.	4	internally connected
V_{osc}	5	oscillator output

Marking

Type.....	catalogue code
Freq...MHz	nominal frequency
Δf25(...Hz)	value for frequency adjustment
Range..°C	temperature range
No.../...	serial number / code for week and year of manufacture

Table 1 Tests and requirements

IEC68-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
Db	accelerated damp-heat	+40 °C 95% R.H.	$\Delta f/f \leq \pm 0.3 \times 10^{-6}$
N	thermal shock	–55 to +105 °C tl = 30 min. 5 cycles relaxation 24 h	$\Delta f/f \leq \pm 0.5 \times 10^{-6}$
Fc	vibration	10–2000 Hz 15 min. or 15 g (fc = 57 Hz) cycletime: 20 min. total time: 12 h	$\Delta f/f \leq \pm 1 \times 10^{-6}$
Ea	shock		$\Delta f/f \leq \pm 1 \times 10^{-6}$
Ta	solderability	235 ± 5 °C. 5 s	good tinning $\Delta f/f \leq \pm 0.5 \times 10^{-6}$
Tb	resistance to solvents		no damage
	storage	16 h at +105 °C 2 h at –55 °C	$\Delta f/f \leq \pm 0.5 \times 10^{-6}$

Philips Components

Data sheet	
status	Product specification
date of issue	March 1991

9922 510 3 series

Temperature compensated crystal oscillator Type TC 304

DESCRIPTION

Temperature compensated crystal oscillators (TCXOs) comprise a quartz crystal oscillator, and a temperature-controlled circuit that compensates for frequency changes over the whole temperature range. The assembly is contained in a metal housing that is dry-nitrogen-filled and hermetically sealed. The package has five connecting pins which are arranged to fit printed-circuit boards with a grid pitch of 2.54 mm.

TESTS AND REQUIREMENTS

See 'Tests and requirements', Table 1

APPLICATIONS

- Mobile telephony
- Electronic timers
- Electronic measuring equipment
- Frequency synthesizers

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
f_n	nominal frequency range	4000	20000	kHz
$\Delta f/f$	frequency stability in the temperature range −20 to +70 °C −40 to +85 °C −40 to +85 °C −55 to −40 °C +85 to +105 °C	 - - - - -	 ± 1 ± 1 ± 2 ± 5 ± 5	 $\times 10^{-6}$ $\times 10^{-6}$ $\times 10^{-6}$ $\times 10^{-6}$ $\times 10^{-6}$
T_{stg}	storage temperature range	−55	+125	°C
V_{CC}	supply voltage	11.4	12.6	V
Z_L	output load	50	1000	Ω
	mass	-	25	g

Temperature compensated crystal oscillator Type TC 304

9922 510 3 series

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CC}	supply voltage		11.4	12	12.6	V
P_{tot}	total power dissipation		-	60	100	mW
f_n	nominal frequency range		4000	-	20000	kHz
Δf/f	frequency tuning range		± 2	± 3	-	x 10^{-6}
Δf/f	frequency stability with respect to the nominal frequency (f_n) after adjustment	ΔT_o = – 20 to +70 °C ΔT_o = – 40 to +85 °C	- -	- -	± 1 ± 1	x 10^{-6} x 10^{-6}
		ΔT_o = – 40 to +85 °C ΔT_o = – 55 to –40 °C ΔT_o = +85 to +105 °C	- - -	- - -	± 2 ± 5 ± 5	x 10^{-6} x 10^{-6} x 10^{-6}
Δf/f	ageing per year		-	-	± 1	x 10^{-6}
Δf/f	frequency deviation due to load impedance variation	ΔZ_L = ± 5%	-	-	± 1	x 10^{-7}
Δf/f	frequency variation due to supply voltage variation	per % V_{CC}	-	-	± 4	x 10^{-8}
Z_L	output load		50	-	1000	Ω
V_{osc}	oscillator output voltage (RMS value)	Z_L = 50 Ω Z_L = 1000 Ω	200 350	- -	- -	mV mV
T_{stg}	storage temperature range		–55	-	+125	°C

Note to electrical data

The nominal frequency is not guaranteed to occur at room temperature. The frequency can be shifted by connecting a variable resistor of max. 1 kΩ between pins 2 and 3. For optimum stability over the whole temperature range, the oscillator should be adjusted to deviate from the nominal frequency by the value given on the label against Δf25 °C .. Hz. After this adjustment, a trimming range of at least ± 2 x 10^{-6} remains available for correcting ageing influences.

Temperature compensated crystal oscillator Type TC 304

9922 510 3 series

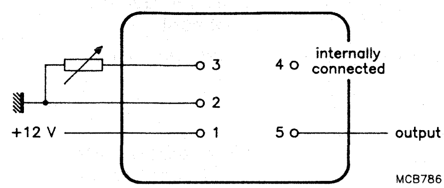


Fig.1 Connection diagram.

MECHANICAL DATA

Dimensions in mm

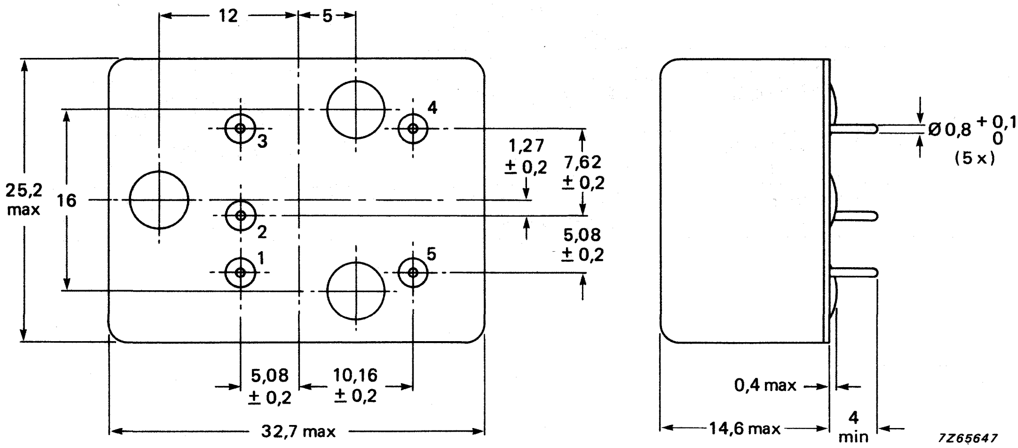


Fig.2 Package outline.

Temperature compensated crystal oscillator Type TC 304

9922 510 3 series

PINNING

SYMBOL	PIN	DESCRIPTION
V_{CC}	1	supply voltage
GND	2	ground (case)
C_{ext}	3	external trimming resistor connected between pin 3 and ground
i.c.	4	internally connected
V_{osc}	5	oscillator output

Marking

Type.....	catalogue code
Freq...MHz	nominal frequency
Δf25 (...Hz)	value for frequency adjustment
Range..°C	temperature range
No../..	serial number / code for week and year of manufacture

Table 1 Tests and requirements

IEC68-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
Db	accelerated damp-heat	+40 °C 95% R.H.	$\Delta f/f \leq \pm 0.3 \times 10^{-6}$
N	thermal shock	–55 to +105 °C tl = 30 min. 5 cycles relaxation 24 h	$\Delta f/f \leq \pm 0.5 \times 10^{-6}$
Fc	vibration	10 – 2000 Hz 15 min. or 15 g (fc = 57 Hz) cycletime: 20 min. total time: 12 h	$\Delta f/f \leq \pm 1 \times 10^{-6}$
Ea	shock		$\Delta f/f \leq \pm 1 \times 10^{-6}$
Ta	solderability	234 ± 5 °C. 5 s	good tinning $\Delta f/f \leq \pm 1 \times 10^{-6}$
Tb	resistance to solvents		no damage
	storage	16 h at +105 °C 2 h at –55 °C	$\Delta f/f \leq \pm 1 \times 10^{-6}$

Philips Components

Data sheet	
status	Product specification
date of issue	March 1991

9922 510 1 series

Temperature compensated crystal oscillator Type TC 305

DESCRIPTION

Temperature compensated crystal oscillators (TCXOs) comprise a quartz crystal oscillator, and a temperature-controlled circuit that compensates for frequency changes over the whole temperature range. The assembly is contained in a metal housing that is dry-nitrogen-filled and hermetically sealed. The package has five connecting pins which are arranged to fit printed-circuit boards with a grid pitch of 2.54 mm.

TESTS AND REQUIREMENTS

See 'Tests and requirements', Table 1

APPLICATIONS

- Mobile telephony
- Electronic timers
- Electronic measuring equipment
- Frequency synthesizers

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
f_n	nominal frequency range	20000	50000	kHz
$\Delta f/f$	frequency stability over temperature range:			
	class 'A'	-	± 1	x 10^{-6}
	class 'B'	-	± 2	x 10^{-6}
	class 'C'	-	± 2	x 10^{-6}
	class 'D'	-	± 3	x 10^{-6}
T_{op}	operating temperature range			
	class 'A'	0	+50	°C
	class 'B'	−20	+70	°C
	class 'C'	0	+50	°C
	class 'D'	−20	+70	°C
V_{CC}	supply voltage			
	class 'A' and 'B'	11.76	12.24	V
	class 'C' and 'D'	10.8	13.2	V
Z_L	load impedance	500	-	Ω
	mass	-	25	g

Temperature compensated crystal oscillator Type TC 305

9922 510 1 series

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CC}	supply voltage type numbers: class 'A' and 'B' class 'C' and 'D'		 11.76 10.8	 12 12	 12.24 13.2	 V V
P_{tot}	total power dissipation		-	160	180	mW
f_n	nominal frequency range		20000	-	50000	kHz
Δf/f	frequency stability with respect to the nominal frequency (f_n) after adjustment:	see Fig 3; see note; ΔT_o<1 K/min; V_{CC} = 12 V Z_L = 500				
	class 'A'	ΔT_o = 0 to 50 °C	-	-	± 1	x 10^{-6}
	class 'B'	ΔT_o = –20 to +70 °C	-	-	± 2	x 10^{-6}
	class 'C'	ΔT_o = 0 to +50 °C	-	-	± 2	x 10^{-6}
	class 'D'	ΔT_o = –20 to +70 °C	-	-	± 3	x 10^{-6}
Δf/f	frequency ageing	per year	-	-	± 1	x 10^{-6}
Δf/f	ageing correction	see note	± 2	-	-	x 10^{-6}
R_i	internal resistance		2660	2800	2940	Ω
C_i	internal capacitance		-	5.5	-	pF
V_i	internal voltage source		-	600	-	mV
Z_L	load impedance		500	-	-	Ω
V_o	output voltage	see Fig.4	-	-	-	V
T_{stg}	storage temperature range		–25	-	+85	°C

Note to electrical data

The nominal frequency is not guaranteed to occur at room temperature. The frequency can be shifted by connecting a variable capacitor (max. 20 pF) between pins 2 and 3. For optimum stability over the whole temperature range, the oscillator should be adjusted to deviate from the nominal frequency by the value given on the label against 'Δf25 °C .. Hz'. After this adjustment, a trimming range of at least ± 2 x 10^{-6} remains available for correcting ageing influences.

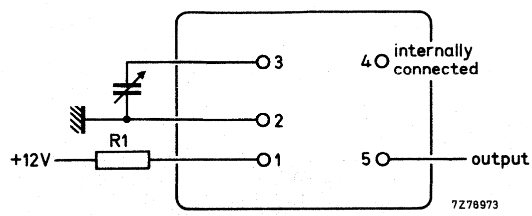


Fig.1 Connection diagram. R1 = 390 Ω.

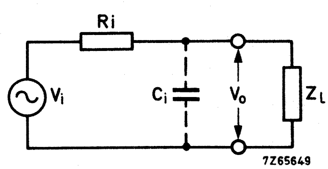


Fig.2 Equivalent circuit.

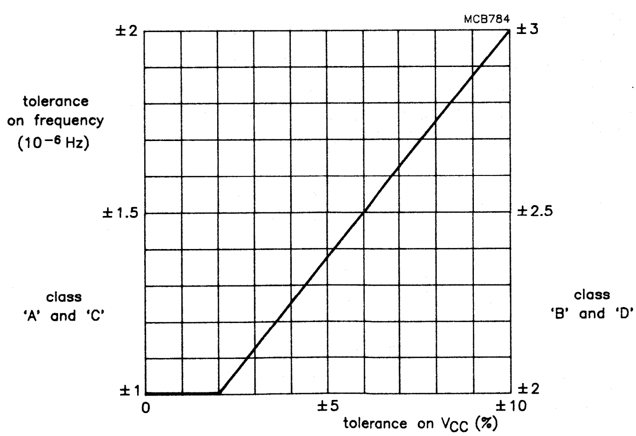


Fig.3 Frequency stability (Δf_n) as a function of the tolerance on supply voltage (V_{CC}) over the whole temperature range.

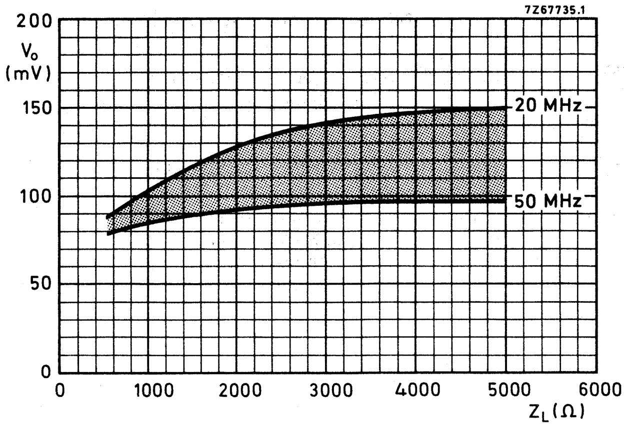


Fig.4 Output voltage (V_o) as a function of load impedance (Z_L); typical values.

MECHANICAL DATA

Dimensions in mm.

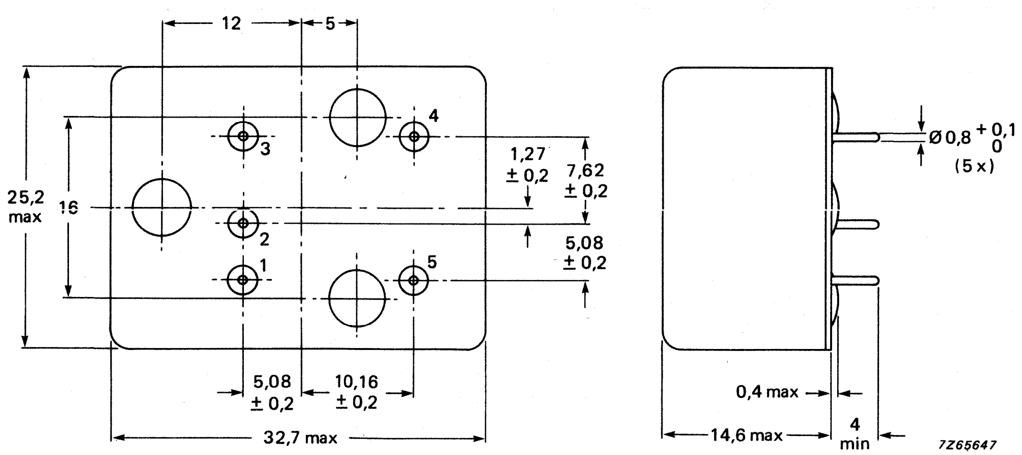


Fig.5 Package outline.

Temperature compensated crystal oscillator Type TC 305

9922 510 1 series

PINNING

SYMBOL	PIN	DESCRIPTION
V_{CC}	1	supply voltage
GND	2	ground (case)
C_{ext}	3	external trimming capacitor connected between pin 3 and GND
i.c.	4	internally connected
V_{osc}	5	oscillator output

Marking

Type	catalogue code
Freq. ...MHz	nominal frequency
Δf25 °C ...Hz	value for frequency adjustment
Range ... °C	temperature range
No. .../....	serial number / code for week and year of manufacture

Table 1 Tests and requirements

IEC68-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
Db	accelerated damp heat	+25 to +55 °C 6 cycles at >95% R.H.	$\Delta f/f < \pm 0.5 \times 10^{-6}$
Ea	shock	50 g 6 directions 1 blow/direction	$\Delta f/f < \pm 0.5 \times 10^{-6}$
Fc	vibration	10-500-10 Hz acceleration 10 g 3 directions 30 min/direction	$\Delta f/f < \pm 0.5 \times 10^{-6}$
Tb	resistance to soldering heat	260 +/– 5 °C 10 +/– 1 s	$\Delta f/f < \pm 0.5 \times 10^{-6}$

Data sheet	
status	Product specification
date of issue	March 1991

9922 513 3 series
Temperature compensated crystal oscillator Type TC 501

DESCRIPTION

Temperature compensated crystal oscillators (TCXOs) comprise a quartz crystal oscillator, and a temperature-controlled circuit that compensates for frequency changes over the whole temperature range. The assembly is contained in a metal housing that is dry-nitrogen-filled and hermetically sealed. The package has five connecting pins which are arranged to fit printed-circuit boards with a grid pitch of 2.54 mm.

TESTS AND REQUIREMENTS

See 'Tests and requirements', Table 1

APPLICATIONS

- Mobile telephony
- Electronic timers
- Electronic measuring equipment
- Frequency synthesizers

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
f_n	nominal frequency range	6000	20000	kHz
$\Delta f/f$	frequency stability in the temperature range: −40 to +85 °C	-	± 1	$x\ 10^{-6}$
T_{op}	operating temperature range	−40	+85	°C
V_{CC}	supply voltage range (fixed value)	5	12	V
Z_L	output load range (fixed value)	50	1000	Ω
	mass	-	10	g

Temperature compensated crystal oscillator Type TC 501

9922 513 3 series

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CC}	supply voltage range fixed value		5		12	V
I_{CC}	supply current		-	4	5	mA
f_n	nominal frequency range		6000	-	20000	kHz
Δf/f	frequency tuning range		± 5	-	-	x 10^{-6}
Δf/f	frequency stability with respect to the nominal frequency (f_n) in the temperature range					
	frequency deviation due to temperature variation	V_{CC} = +5 to +12 V T_o = −20 to +70 °C T_o = −40 to +85 °C V_{CC} = 12 V only T_o = −40 to +85 °C T_o = −55 to −40 °C T_o = +85 to +105 °C	 - - - - -	 - - - - -	 ± 1 ± 1 ± 2 ± 5 ± 5	 x 10^{-6} x 10^{-6} x 10^{-6} x 10^{-6} x 10^{-6}
Δf/f	ageing	per year	-	-	± 1	x 10^{-6}
Δf/f	frequency deviation due to load impedance variation	ΔZ_L = ± 10%	-	-	± 0.2	x 10^{-6}
Δf/f	frequency variation due to supply voltage variation	V_{CC} ± 5%	-	-	± 0.1	x 10^{-6}
	phase noise	at 1 kHz	-	-	−130	dB_c/Hz
V_{osc}	output voltage (RMS value)	Z_L = 50 Ω Z_L = 1000 Ω	80 350	- -	- -	mV mV
T_{stg}	storage temperature range		−55		+125	°C

Note to electrical data

The nominal frequency is not guaranteed to occur at room temperature. The frequency can be shifted by connecting a variable resistor (0 to 10 kΩ) between pins 4 and 5. For optimum stability over the whole temperature range, the oscillator should be adjusted to deviate from the nominal frequency by the value given on the label against 'Δf25 °C .. Hz'. After this adjustment, a trimming range of at least ± 5 x 10^{-6} remains available for correcting ageing influences.

Temperature compensated crystal oscillator Type TC 501

9922 513 3 series

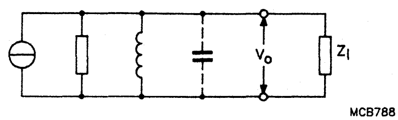


Fig.1 Equivalent output circuit.

MECHANICAL DATA

Dimensions in mm

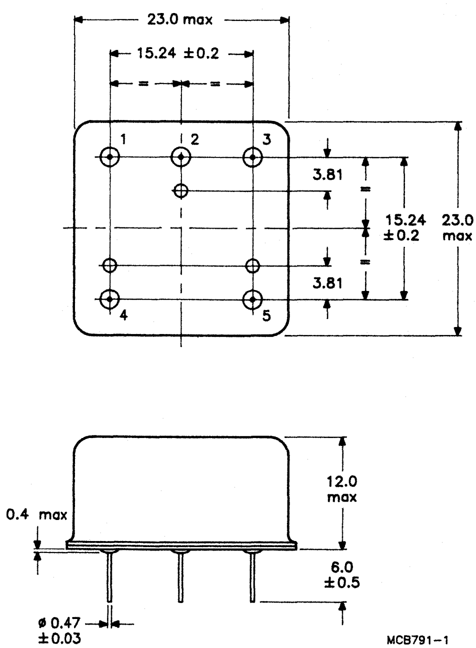


Fig.2 Package outline.

Temperature compensated crystal oscillator Type TC 501

9922 513 3 series

PINNING

SYMBOL	PIN	DESCRIPTION
V_{CC}	1	supply voltage
V_{osc}	2	oscillator output
GND	3	ground (case)
R_{ext}	4	external trimming resistor connected between pin 4 and GND
GND	5	ground (case)

Marking

Δf25 °C ...Hz	value for frequency adjustment
Freq ....MHz	nominal frequency
Type	catalogue code
No. .../...	serial number /code for week and year of manufacture

Table 1 Tests and requirements

IEC68-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
Db	accelerated damp-heat	+40 °C 95% R.H.	$\Delta f/_f \leq \pm 0.3 \times 10^{-6}$
N	thermal shock	–55 to +105 °C t_l = 30 min. 5 cycles relaxation 24 h	$\Delta f/_f \leq \pm 0.5 \times 10^{-6}$
Fc	vibration	10-2000 Hz 15 g total time 4 h/axis one octave/minute	$\Delta f/_f \leq \pm 1 \times 10^{-6}$
Ea	shock	50 g (1/2 sine) 6 directions 1 blow/direction	$\Delta f/_f \leq \pm 1 \times 10^{-6}$
T	solderability	235 ± 5 °C, 5 s	good tinning
Tb	resistance to soldering heat	260 °C ± 5 °C max 10 s ± 1 s	$< \pm 1 \times 10^{-6}$

Philips Components

Data sheet	
status	Product specification
date of issue	March 1991

9922 513 1 series

Temperature compensated crystal oscillator Type TC 502

DESCRIPTION

Temperature compensated crystal oscillators (TCXOs) comprise a quartz crystal oscillator, and a temperature-controlled circuit that compensates for frequency changes over the whole temperature range. The assembly is contained in a metal housing that is dry-nitrogen-filled and hermetically sealed. The package has five connecting pins which are arranged to fit printed-circuit boards with a grid pitch of 2.54 mm.

TESTS AND REQUIREMENTS

See 'Tests and requirements', Table 1

APPLICATIONS

- Mobile telephony
- Electronic timers
- Electronic measuring equipment
- Frequency synthesizers

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
f_n	nominal frequency range	6000	20000	kHz
$\Delta f/f$	frequency stability in the temperature range: –40 to +85 °C	-	± 1	x 10^{-6}
T_{op}	operating temperature range	–40	+85	°C
V_{CC}	supply voltage	4.75	5.25	V
Z_L	output load	-	3	LSTTL load
	mass	-	10	g

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CC}	supply voltage		4.75	-	5.25	V
I_{CC}	supply current		-	4	6	mA
f_n	nominal frequency range		6000		20000	kHz
$\Delta f/f$	frequency tuning range		± 5	-	-	$\times 10^{-6}$
$\Delta f/f$	frequency stability with respect to the nominal frequency (f_n) in the temperature range	V_{CC} = 5 V ΔT_o = −20 to +70 °C ΔT_o = −40 to +85 °C	 - -	 - -	 ± 1 ± 1	 $\times 10^{-6}$ $\times 10^{-6}$
$\Delta f/f$	ageing	per year	-	-	± 1	$\times 10^{-6}$
$\Delta f/f$	frequency variation due to supply voltage variation	V_{CC} ± 5%	-	-	± 0.1	$\times 10^{-6}$
	phase noise	at 1 kHz	-	-	−130	dB_c/Hz
Z_L	output load (fan out)		-	-	3	LSTTL load
T_{stg}	storage temperature range		−55	-	+125	°C

Note to electrical data

The nominal frequency is not guaranteed to occur at room temperature. The frequency can be shifted by connecting a variable resistor (0 to 10 kΩ) between pins 4 and 5. For optimum stability over the whole temperature range, the oscillator should be adjusted to deviate from the nominal frequency by the value given on the label against ‘Δf25 °C .. Hz’. After this adjustment, a trimming range of at least ± 5 x 10^{-6} remains for correcting ageing influences.

Temperature compensated crystal oscillator Type TC 502

9922 513 1 series

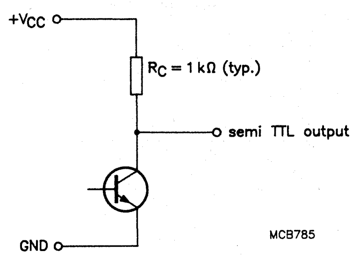


Fig.1 Equivalent output circuit.

MECHANICAL DATA

Dimensions in mm

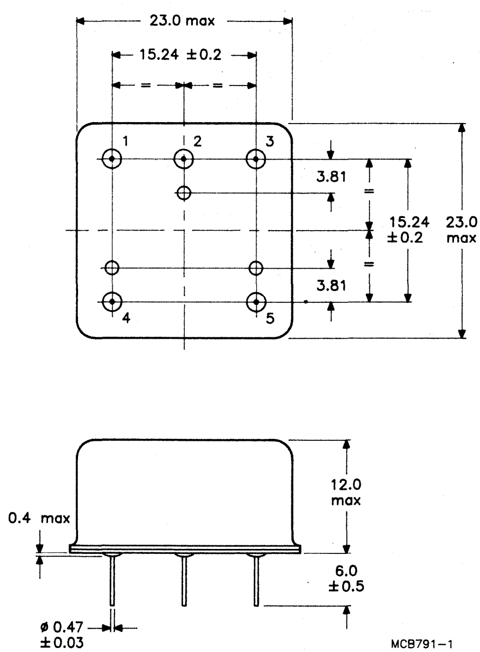


Fig.2 Package outline.

Temperature compensated crystal oscillator Type TC 502

9922 513 1 series

PINNING

SYMBOL	PIN	DESCRIPTION
V_{CC}	1	supply voltage
V_{osc}	2	oscillator output
GND	3	ground (case)
R_{ext}	4	external trimming resistor connected between pin 4 and GND
GND	5	ground (case)

Marking

Δf25 °C ..Hz	value for frequency adjustment
Freq. ...MHz	nominal frequency
Type	catalogue code
No. .../....	serial number / code for week and year of manufacture

Table 1 Tests and requirements

IEC68-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
Db	accelerated damp-heat	+40 °C 95% R.H.	$\Delta f/f \leq \pm 0.3 \times 10^{-6}$
N	thermal shock	–55 to +105 °C tl = 30 min. relaxation 24 h	$\Delta f/f \leq \pm 0.5 \times 10^{-6}$
Fc	vibration	10-2000 Hz total time 4 h/axis one octave/minute	$\Delta f/f \leq \pm 1 \times 10^{-6}$
Ea	shock	50 g (1/2 sine) 6 directions 1 blow / direction	$\Delta f/f \leq \pm 1 \times 10^{-6}$
Ta	solderability	235 ± 5 °C 5 s	good tinning
Tb	resistance to soldering heat	260 °C ± 5 °C max 10 s ± 1 s	$< \pm 1 \times 10^{-6}$

Data sheet	
status	Product specification
date of issue	March 1991

9922 514 3 series
Temperature compensated crystal oscillator Type TC 601

DESCRIPTION

Temperature compensated crystal oscillators (TCXOs) comprise a quartz crystal oscillator, and a temperature-controlled circuit that compensates for frequency changes over the whole temperature range. The assembly is contained in a metal housing. The package has four connecting pins which are arranged to fit printed-circuit boards with a grid pitch of 2.54 mm.

TESTS AND REQUIREMENTS

To be fixed.

APPLICATIONS

- Mobile telephony
- Electronic timers
- Electronic measuring equipment
- Frequency synthesizers

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
f_n	nominal frequency range	6000	20000	kHz
$\Delta f/f$	frequency stability in the temperature range: −20 to +70 °C	-	± 1	x 10^{-6}
T_{op}	operating temperature range	−20	+70	°C
V_{CC}	supply voltage range fixed value	5	12	V
Z_L	output load range	50	1000	Ω
	mass	-	10	g

Temperature compensated crystal oscillator Type TC 601

9922 514 3 series

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CC}	supply voltage range fixed value		5	-	12	V
I_{CC}	supply current		-	4	5	mA
f_n	nominal frequency range		6000	-	20000	kHz
Δf/f	frequency tuning range		± 5	-	-	x 10^{-6}
Δf/f	frequency stability with respect to the nominal frequency (f_n) in the temperature range	ΔT_{op} = −20 to +70 °C	-	-	± 1	x 10^{-6}
Δf/f	ageing	per year	-	-	± 1	x 10^{-6}
Δf/f	frequency variation due to load impedance variation	ΔZ_L = ± 10%	-	-	± 0.2	x 10^{-6}
Δf/f	frequency variation due to supply voltage variation	V_{CC} ± 5%	-	-	± 0.1	x 10^{-6}
	phase noise	at 1 kHz	-	-	−130	dB_c/Hz
V_{osc}	output voltage (RMS value)	Z_L = 50 Ω Z_L = 1000 Ω	80 350	- -	- -	mV mV
T_{stg}	storage temperature range		−40	-	+85	°C

Note to electrical data

The nominal frequency is not guaranteed to occur at room temperature. The frequency can be shifted by connecting a variable resistor (0 to 10 kΩ) between pins 4 and 5. For optimum stability over the whole temperature range, the oscillator should be adjusted to deviate from the nominal frequency by the value given on the label against 'Δf25 °C .. Hz'. After this adjustment, a trimming range of at least ± 5 x 10^{-6} remains available for correcting influences.

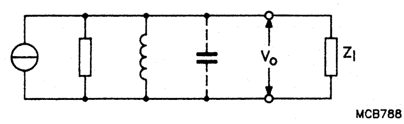


Fig.1 Equivalent output circuit.

MECHANICAL DATA

Dimensions in mm

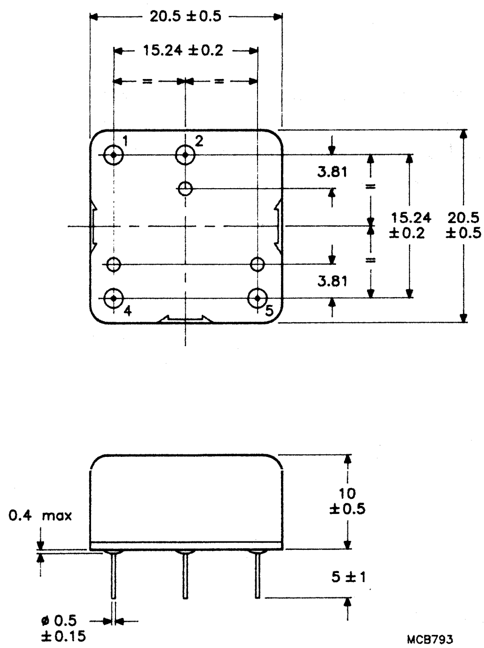


Fig.2 Package outline.

Temperature compensated crystal oscillator Type TC 601

9922 514 3 series

PINNING

SYMBOL	PIN	DESCRIPTION
V_{CC}	1	supply voltage
V_{osc}	2	oscillator output
R_{ext}	4	external trimming resistor connected between pin 4 and 5
GND	5	ground (case)

Marking

Δf25 °C ..Hz	value for frequency adjustment
Freq. ...MHz	nominal frequency
Type	catalogue code
No. .../....	serial number / code for week and year of manufacture

Philips Components

Data sheet	
status	Product specification
date of issue	March 1991

9922 514 1 series

Temperature compensated crystal oscillator Type TC 602

DESCRIPTION

Temperature compensated crystal oscillators (TCXOs) comprise a quartz crystal oscillator, and a temperature-controlled circuit that compensates for frequency changes over the whole temperature range. The assembly is contained in a metal housing. The package has four connecting pins which are arranged to fit printed-circuit boards with a grid pitch of 2.54 mm.

TESTS AND REQUIREMENTS

To be fixed.

APPLICATIONS

- Mobile telephony
- Electronic timers
- Electronic measuring equipment
- Frequency synthesizers

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
f_n	nominal frequency range	6000	20000	kHz
$\Delta f/f$	frequency stability in the temperature range: −20 to +70 °C	-	± 1	x 10^{-6}
T_{op}	operating temperature range	− 20	+70	°C
V_{CC}	supply voltage range	4.75	5.25	V
Z_L	output load (fan out)	-	3	LSTTL load
	mass	-	10	g

Temperature compensated crystal oscillator Type TC 602

9922 514 1 series

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CC}	supply voltage range		4.75	5	5.25	V
I_{CC}	supply current		-	4	6	mA
f_n	nominal frequency range		6000		20000	kHz
Δf/f	frequency tuning range		± 5	-	-	x 10^{-6}
Δf/f	frequency stability with respect to the nominal frequency (f_n) in the temperature range	V_{CC} = 5 V ΔT_o = −20 to +70 °C	-	-	± 1	x 10^{-6}
Δf/f	ageing	per year	-	-	± 1	x 10^{-6}
Δf/f	frequency variation due to supply voltage variation	V_{CC} ± 5%	-	-	± 0.1	x 10^{-6}
	phase noise	at 1 kHz	-	-	−130	dB_c/Hz
Z_L	output load (fan-out)		-	-	3	LSTTL load
T_{stg}	storage temperature range		−40	-	+85	°C

Note to electrical data

The nominal frequency is not guaranteed to occur at room temperature. The frequency can be shifted by connecting a variable resistor (0 to 10 kΩ) between pins 4 and 5. For optimum stability over the whole temperature range, the oscillator should be adjusted to deviate from the nominal frequency by the value given on the label against 'Δf25 °C .. Hz'. After this adjustment, a trimming range of at least ± 5 x 10^{-6} remains available for correcting influences.

Temperature compensated crystal oscillator Type TC 602

9922 514 1 series

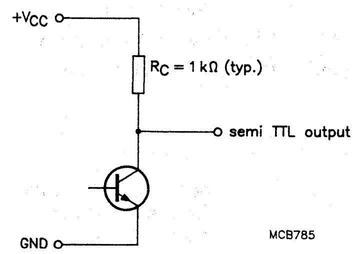


Fig.1 Equivalent output circuit.

MECHANICAL DATA

Dimensions in mm

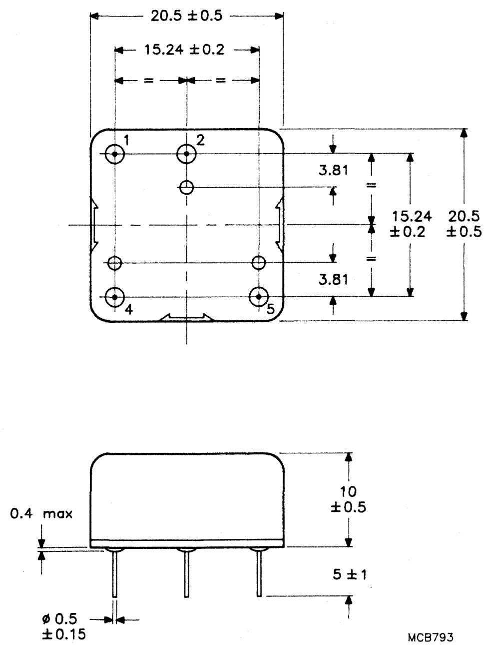


Fig.2 Package outline.

Temperature compensated crystal oscillator Type TC 602

9922 514 1 series

PINNING

SYMBOL	PIN	DESCRIPTION
V_{CC}	1	supply voltage
V_{osc}	2	oscillator output
R_{ext}	4	external trimming resistor connected between pin 4 and 5
GND	5	ground (case)

Marking

Δf25 °C ...Hz	value for frequency adjustment
Freq ....MHz	nominal frequency
Type ....Hz	catalogue code
No. .../....	serial number / code for week and year of manufacture

Data sheet	
status	Product specification
date of issue	March 1991

9922 519 3 series
Digital temperature compensated crystal oscillator (DTCXO)

DESCRIPTION

Digital temperature-compensated crystal oscillators (DTXCOs) comprise a quartz crystal oscillator, a quartz crystal temperature measuring device and an electronic compensation network that is digitally controlled. The assembly is contained in a metal housing that is dry-nitrogen-filled and hermetically sealed. The package has four connecting studs and can be mounted on a printed-circuit board and/or secured by four bolts (M3).

TESTS AND REQUIREMENTS

See 'Tests and requirements', Table 1.

FEATURES

- Very high stability
- Low power consumption

APPLICATIONS

- Communication and measuring equipment which require high stability and low power consumption

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
f_n	nominal frequency range	4 000	15 000	kHz
Δf/f	frequency stability in the temperature range: −40 to +85 °C	-	± 0.5	x 10^{-6}
T_{op}	operating temperature range	−40	+85	°C
V_{CC}	supply voltage	4.75	5.25	V
Z_L	output load (fan-out):	- - -	10 2 10	LSTTL load TTL load HCMOS load
	mass	-	70	g

Digital temperature compensated crystal oscillator (DTCXO)

9922 519 3 series

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating conditions						
V_{CC}	supply voltage		4.75	5	5.25	V
I_{CC}	supply current		-	15	20	mA
Z_L	output load (fan out)		- - -	- - -	10 2 10	LSTTL load TTL load HCMOS load
T_{op}	operating temperature range		–40	-	+85	°C
T_{stg}	storage temperature range		–55	-	+125	°C
Frequency characteristics						
f_n	nominal frequency range		4000	-	15000	kHz
$\Delta f/f$	frequency stability with respect to the nominal frequency (f_n): in the temperature range		-	-	± 0.5	x 10^{-6}
$\Delta f/f$	frequency deviation due to supply voltage variations	V_{CC} = 4.75 to 5.25	-	-	± 0.1	x 10^{-6}
$\Delta f/f$	frequency ageing	during 10 years at 85 °C	-	-	± 1.5	x 10^{-6}
	stabilization time: to reach a stability within 5 x 10^{-7}		-	-	1	s
Δfn	frequency trimming range		± 2	-	-	x 10^{-6}
Output characteristics						
	duty cycle	output level = 1.4 V	40	-	60	%

Note to the electrical data

For optimum stability over the whole temperature range, the oscillator should be adjusted at room temperature to a frequency which deviates from the nominal frequency by an amount indicated on the label, located on the oscillator.

Digital temperature compensated crystal oscillator (DTCXO)

9922 519 3 series

MECHANICAL DATA

Dimensions in mm

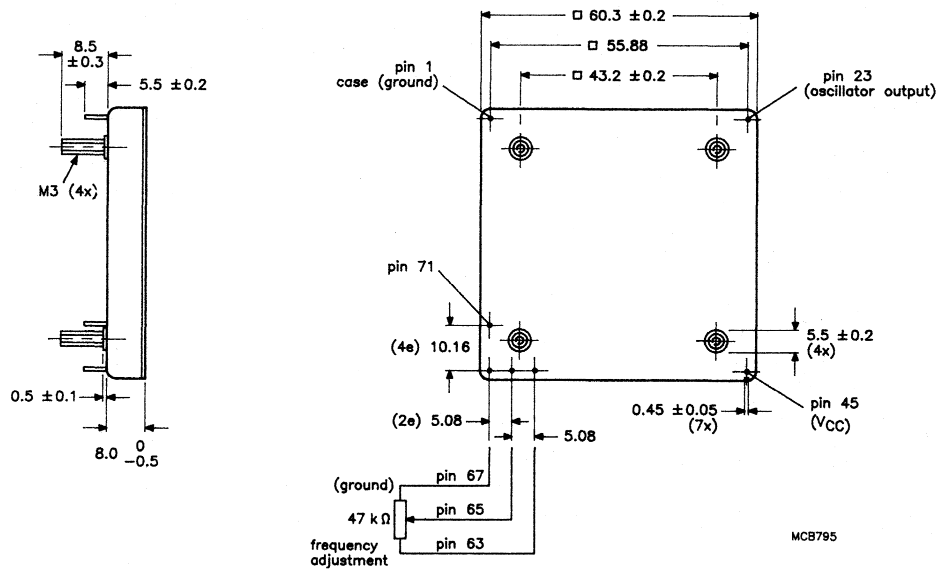


Fig.1 Package outline.

Digital temperature compensated crystal oscillator (DTCXO)

9922 519 3 series

PINNING

SYMBOL	PIN	DESCRIPTION
GND	1	ground (case)
V_{osc}	23	oscillator output voltage
V_{CC}	45	supply voltage
V_{ref}	63	frequency adjustment reference voltage
V_{I}	65	frequency adjustment input voltage
GND	67	ground (frequency adjustment only)
n.c.	71	not connected

Marking

Type	catalogue code
Freq. ...MHz	nominal frequency
Δf25 °C ..Hz	value for frequency adjustment
Range ... °C	temperature range
No. .../....	serial number / code for week and year of manufacture

Table 1 Tests and requirements

IEC68-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
D_b	accelerated damp-heat	+25 °C to +55 °C 6 cycles at >95% R.H.	$\Delta f/f \leq \pm 0.2 \times 10^{-6}$
Ea	shock	50 g 6 v directions 1 blow/direction	$\Delta f/f \leq \pm 0.2 \times 10^{-6}$
Fc	vibration	10-500-10 Hz acceleration 10 g 3 directions 30 min./direction	$\Delta f/f \leq \pm 0.2 \times 10^{-6}$
Tb	resistance to soldering heat	260 °C ± 5 °C 10 +/−1 s	$\Delta f/f \leq \pm 0.2 \times 10^{-6}$

Philips Components

Data sheet	
status	Objective specification
date of issue	March 1991

9922 515 8 series
Temperature sensoring oscillator (TSO)

DESCRIPTION

A TSO comprises a quartz crystal which is cut under a special angle. The frequency varies as a linear function of temperature. The temperature information is available as a number of pulses which changes with temperature, no analog-to-digital conversion is needed. The crystal and the oscillator are built in hybrid technology. The unit is encapsulated in a metal package which is filled with dry nitrogen and hermetically sealed. The unit has a pinning which is compatible with 14-pin DIL packages. Upon request the TSO can be supplied with a Master Reset input in order to minimize standby power consumption.

TESTS AND REQUIREMENTS

See 'Tests and requirements'
To be fixed.

APPLICATION

- Temperature sensing devices in very accurate thermometers
- Temperature monitors in electronic systems

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f_n	nominal frequency range		0.25	-	750	kHz
T_{op}	operating temperature range		−40	-	+85	°C
TC	temperature coefficient range		−50	-	+85	x 10^{-6}/K
	output compatibility		-	HCMOS	-	-
V_{CC}	supply voltage range		4.5	5.0	5.5	V
I_{CC}	supply current		-	2.5	-	mA

Temperature sensoring oscillator (TSO) 9922 515 8 series

ELECTRICAL DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating conditions						
V_{CC}	supply voltage		4.5	5.0	5.5	V
I_{CC}	supply current	note 1	-	2.5	-	mA
T_{op}	operating temperature range		–40	25	+85	°C
t_s	start-up time		-	2	-	ms
Frequency characteristics						
f_n	nominal frequency range		0.25	-	750	kHz
TC	temperature coefficient range	note 2	–50	-	+85	x 10^{-6}/K
	linearity	note 3	-	1	-	%
t_{th}	thermal time constant		-	10	-	s
Output characteristics						
V_{OH}	output voltage HIGH	V_{CC} = 4.5 V I_O = –4.0 mA	3.7	-	-	V
V_{OL}	output voltage LOW	V_{CC} = 4.5 V I_O = 4.0 mA	-	-	0.4	V
	duty cycle	V_{CC} / 2	45	-	55	%
	output load		-	-	50 3	pF TTL
Master Reset (optional) A logic 1 on the MR input stops the oscillator and sets the output to the low state. Current reduces to 0.1 mA.						
V_{IH}	input voltage HIGH		2.0	-	-	V
V_{IL}	input voltage LOW		-	-	0.8	-
T_{stg}	storage temperature range		–55	-	+100	°C

Notes to the electrical data

1. Maximum value dependent on frequency and load
2. Choose value within range
3. Dependent on TC and T_{op} range

Temperature sensoring oscillator (TSO) 9922 515 8 series

MECHANICAL DATA

Dimensions in mm

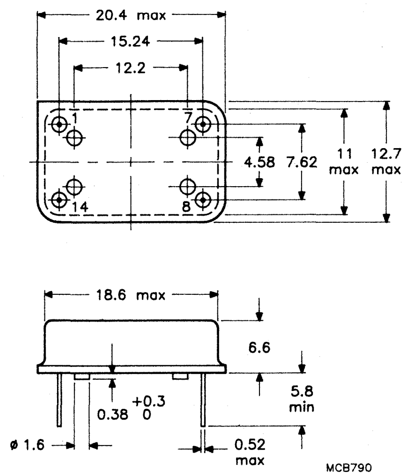


Fig.1 Package outline.

PINNING

SYMBOL	PIN	DESCRIPTION
N/C or MR	1	not connected or master reset (optional)
GND	7	ground (case)
V_{osc}	8	oscillator output
V_{CC}	14	supply voltage

MARKING

frequency in kHz
last five digits of catalogue code
code for month and year of manufacture

DATA HANDBOOK SYSTEM

DATA HANDBOOK SYSTEM

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MAGNETIC PRODUCTS*

LIQUID CRYSTAL DISPLAYS

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